BRISTOL BAY UPWARD-LOOKING SONAR SOCKEYE SALMON SMOLT ENUMERATION PROJECT INSTRUCTION MANUAL

by

Drew L. Crawford

and

Frederick C. Tilly

Regional Information Report[1] No. 2A95-14

Alaska Department of Fish and Game
Division of Commercial Fisheries Management and Development
Regional Office
333 Raspberry Road
Anchorage, Alaska 99518-1599

May 1995

[1] Contribution 95-14 from the Anchorage regional office. The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished divisional reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate needs for up-to-date information, reports in this series may contain preliminary data.

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AUTHORS

Drew L. Crawford is a Region II Bristol Bay Research Biologist for the Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, 333 Raspberry Road, Anchorage, AK 99518-1599

Frederick C. Tilly is a Region II Bristol Bay Fishery Biologist for the Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, P.O. Box 37, King Salmon, AK 99613-0037

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PREFACE

This second edition of the smolt instruction manual was primarily prepared to update procedures which have changed or were not included in the first unpublished edition. These additions were needed to document current smolt sampling techniques and standardize like practices between all Bristol Bay smolt sonar projects.

The manual will be updated periodically by the project leader to keep all smolt project personnel current with the latest smolt sampling techniques and procedures.

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INTRODUCTION

Hydroacoustic equipment has been used in the Bristol Bay Management Area to estimate outmigrating sockeye salmon *Oncorhynchus nerka* smolt numbers on the Kvichak, Naknek, Egegik, Ugashik, Wood, Nuyakuk, and Togiak Rivers (Figure 1). Since 1991 all smolt enumeration studies have been restricted to eastside Bristol Bay tributaries.

The four objectives of the program are to (1) estimate sockeye salmon smolt numbers, (2) determine smolt outmigration patterns, (3) collect age, weight and length information, and (4) monitor the weather conditions, especially water temperatures during the outmigration. This information is used to forecast age composition and size of subsequent adult returns, and to evaluate adult escapement goals.

Upward-looking sonar is used to estimate numbers of outmigrating sockeye salmon smolt. Fyke nets will be used to obtain samples for age, weight, and length data. A small weather station is set up to monitor various parameters, the most important being water temperature.

LOGISTICS

Personnel

Three-to-four seasonal fishery employees comprise each field crew which installs, operates, and removes the smolt enumeration and sampling equipment, along with reporting the smolt data on a daily basis. One seasonal employee will be designated as crew leader. In the absence of the project biologist, the seasonal employees will act as the Department spokesmen in answering public inquiries about the purpose and day-to-day activities of the program.

Anchorage

Most purchases will be made in Anchorage. Some materials are brought to Anchorage at the end of the field season, and need to be brought back to the field each year (Appendix A).

King Salmon

Equipment is brought to King Salmon at the end of each field season for various reasons. This equipment needs to be located, repaired if necessary, and flown to the sonar camp each spring (Appendix B). Refer to last years equipment inventory in your projects 3-ring binder entitled *Data Forms* for specifics about equipment items that you need for your project and where you should look to find them.

As you stage your equipment for your initial flight to your field camp, complete the initial phase of your equipment inventory. Provide a detailed accounting of the quantity, item description, manufacturers name, model number, serial number, State of Alaska property number, the condition, and the storage location (e.g., KS/Warm Storage, KS/Shop) of all equipment items that originate in King Salmon each season. Pay particular attention to the storage location, this will help you at the end of the season when you put the same items away. All new equipment items and those which were not included on the prior year equipment inventory should be recorded on the Equipment Inventory form (Appendix C.1).

Keep track of the fuel purchased for, shipped to, and consumed by your project during the course of the field season on the Field Camp Gas and Oil Consumption Form (Appendix C.2). This information is immensely helpful when it comes time to budget fuel needs for next year's project.

For your own benefit, it is also helpful to keep track of the quantity of all items needed or consumed on an annual basis by your project. Keep track of items such as data forms, microscope slides (e.g., clear and frosted), rolls of printer paper, MS-222 anesthetic, etc. If your project leader knows how much you use or need of each of these items he can insure that you will have enough of each of these items on hand during the season to get the job done.

Smolt Camp

All sonar gear and fyke nets stored at the camp need to be located. The boats should be inspected, repaired if necessary, and launched.

A wall tent will be set up at the sonar tent site. Any equipment necessary for the operation of the sonar system should also be transported to the sonar site (i.e. battery, stove, forms, etc.; Appendix D).

A slow survey of the river should be made from the fyke net site to the sonar site noting channel location. All submerged rocks in the main channel should be marked with buoys.

In order to comply with existing land use permits for operation of all smolt sonar projects, it is vital that these projects have a minimum impact upon the land and water in the areas where we work. It is particularly important that no waste or waste water is discharged into any stream, river, or lake at or near the camp or smolt sonar site. Keep your operation clean.

SONAR SMOLT COUNTER

The sonar smolt counter consists of two basic parts: (1) a transducer component, and (2) an electronic control unit.

Transducer Component

The transducer component includes 1) transducers, 2) a plastic ladder array and anchoring system, and 3) cables which transmit electronic signals between the transducers and control unit.

The single-element International Transducer Corporation, Model 5095 transducers are canister shaped devices (3" in diameter by 6" long) permanently sealed to prevent water leakage. Inside of this PVC canister is a small disc-shaped ceramic piece that transmits and receives sonar signals. The ceramic piece is designed to emit a high frequency sound wave of 235 kilohertz and a half power beam width angle of 9° when triggered by the control unit.

The disc is epoxied to the inside face of one end of the transducer. This ceramic disc is in turn connected by a wire that exits through a water tight opening on the side of the canister near the end opposite the face. The wire continues through a 330' coaxial cable that ultimately attaches to the control unit.

Three transducer arrays are used at each smolt sonar site, except Ugashik River. Only two arrays are used at Ugashik River due to the narrower channel width. Each assembled array is 11' in length, composed of PVC plastic and coated with olive drab paint. On each array, ten rungs support the receptacles for ten upward-facing transducers. On the ends of the main rails there may be a pair of one-way valves used to fill the array with air or water. One valve is threaded for the attachment of a standard 5/8" plastic garden hose.

The Naknek, Egegik, and Ugashik River smolt projects have simplified the raising and lower of their arrays by cutting off the caps or drilling holes in both ends of each of their arrays to facilitate the raising and lower of the arrays.

The entire array with transducers mounted in place is flooded with water and anchored to the bottom of the river. The anchoring system consists of a 3/16" cable bridle attached by snap hooks to the array which is in turn suspended from a combination rope, cable, and chain line attached to an anchor at least 100 feet upriver.

Control Unit

The control panel (Figure 2) houses a digital totalizer, range controls, and banks of LED lights for each of the arrays (2 for Ugashik and 3 for Egegik, Naknek, and Kvichak). This permits monitoring of individual transducers and provides instantaneous information on the counts being recorded by each array unit. The yellow LED lights on the control panel indicate that the logic card in the smolt counter is working properly. When these yellow lights are lite, everything should be working fine. If the yellow lights go out, you have a problem.

The top-center dial on the control unit permits the operator to adjust the transmitting rate of the sonar depending on the water velocity of the river.

The lower-center dial on the control unit is used to adjust the printout time interval. The dial next-to-it automatically clears and resets the starting time of the printer to allow the operator to synchronize the unit with the correct time.

The final product of the system is printed out at the desired time interval on a paper tape which exits the unit on the lower left side of the box. The printer and digital totalizers are not separate units so that clearing the digital counters <u>does destroy</u> counts stored in the printer electronics.

SONAR SITE

Figures 3-6 show the locations of the smolt sonar sites. The width of the channel should be covered by the arrays available and be monitored from one side of the river. The water depths should be within the operating range of the sonar. Sites should be reasonably protected from the wind since white caps place entrained air in the water which causes false sonar counts.

The river bottom should be flat so the arrays rest in a horizontal aspect with all transducers approximately the same distance from the surface. This facilitates the electronic leveling of the arrays and sets the range of all transducers as near the surface as possible.

GEAR INSTALLATION

Preparation of Array

The transducer component requires the most preparation in making the system operational. Both transducers and control unit are kept in warm storage in King Salmon during the winter. To minimize the chances of damage, the controls and transducer for each array are transported to the site in protective wooden boxes. The plastic ladder assemblies are stored at the main camp along with most of the remaining components of the system. The assembly of the transducer component or array is completed on the beach.

The first chore of the season is to prepare the arrays for mounting of transducers (Figure 7). The arrays are thoroughly flushed with water to remove all sand and gravel from the rung members and from the one way valves located on the ends of the main rails. This will ease the task of attaching transducers and decrease the chances of obstructed valves which complicate the flooding and/or evacuation of water in the main rails. Check the ladders for proper alignment and be certain that all pipe clamps securing the mounts and rungs to the main rails are tight. A standard screwdriver will loosen and/or tighten the array parts. Examine the entire array for cracks, loose end caps, or loose one-way valves. PVC cement can be used for any repairs. Also examine the two bands and snap hooks located at either end of the main rails. After this, the transducers can be attached to the arrays.

Examination of Transducers

The next job will be to unpack and examine the transducers. The individual transducers are very expensive ($1,200.00 each) and difficult to replace, so be careful when handling and installing them.

When unpacking and preparing the transducers for mounting, remember they are to be placed in the frame as designated in the accompanying illustrations. The wooden boxes containing them should be labeled according to the array to which they belong (in-shore, center, off-shore). A second number is found on both ends of the transducer cable. These are self-sticking wire markers or numbered tapes wrapped around the cable corresponding to the location on the ladder array where the transducer is to be attached. If any of these numbered tapes have unwrapped or completely fallen off, replace them with the appropriately numbered new tape.

Unravel the individual transducer wires so that the transducers can be laid out one-by-one behind the arrays. Since the main wiring bundle was taped prior to packing the previous year, the individual transducers will unravel much in the same manner as the wiring for an automobile distributor cap where each wire end will just reach its respective spark plug. After this is completed, shake each transducer to be sure it does not contain water. Those with water must be removed and replaced with new transducer units. Examine the transducers, cables, and connectors for any damage. Repair or replace any defects that are found before proceeding to the next step.

Array Assembly

At this point, the transducers are ready to be mounted on arrays. The 10 receptacles on each of the arrays are numbered to aid in locating the appropriate position of each transducer. Transducers are numbered 1-10. With transducer #1 located closest to the smolt counter and transducer #10 located farthest away from the smolt counter on each array (Figure 8).

Place the transducers near their appropriate slot. Care must be taken that the wire on the side of the transducers is not broken loose in handling. Dropping or striking the transducers can loosen the ceramic piece inside or cause cracks which will leak underwater.

The cross rails have a hub set vertically through the middle and the transducers are slipped in from the bottom and held in place with a removable transducer flange (Figure 9). These astic flanges have a slot through which the transducer cable is fitted. The flanges are then astened to the hub with two sheet metal screws. Fasten the flange such that the slot for the transducer cable will direct the cable toward the main rail with the cannon mounts (this will aid in stringing the cables along the array members). Never pound the face of a transducer in an effort to drive it into the slot. A slight back and forth rotation is usually all that's necessary.

After all transducers are securely in place, the wires are neatly strung along the downstream side of the array members and main rails until coming together at a common point near the hose fitted end of the downstream main rail. The wires are secured with electrical tape whenever necessary to eliminate sagging sections that may work loose in the water current. Where possible, run the wire on the downstream side of members in places that will make them less vulnerable to snagging by passing debris. Avoid bending the cables over where they exit from the transducers since this may cause strain on the water tight seals. Also when taping wires on, do not pass them over any sharp metal edges or screw heads which might wear away the insulation on the wire.

The combined cable bundles are then strung out along the river bank in order to attach a supportive 3/8" manila line. The line is first tied to the array and then continued along the cable bundle in a series of double half hitches tied about 10 feet apart in such a way that extension of the finished bundle places tension on the line and not on the wires. Be careful when attaching the line to the array and make sure that the line places tension on the line only and not on the transducer cables. Also be sure that there are no loose lines or cables that will drift across the face of any transducers when it is placed in the river.

After the arrays are completely assembled and outfitted with transducers, all light colored spots and bare metal should be painted with olive-drab paint. Do not to get any paint on the face of the transducers. Any unpainted metal surface may cause avoidance by the smolts and bias the statistical expansion of counts. Don't neglect to paint the shiny areas on the cable bridle, cable snaps, shackles or clamps. The easiest way to coat these is to dip them in the paint and allow them to dry before using.

Next lay out the entire cable and line assembly along the river bank to double check all knots and remove any kinks or tangles in the bundle. Using the same wooden box that the transducers were shipped in, place the loose ends (with the cable connectors) of the cable bundle in the bottom of the box and coil the remainder of the cable bundle neatly on top. This will allow the cable bundle to feed out smoothly when the array is placed in the river and the cable bundle is driven back to shore with the skiff.

Attach a pair of 25' lengths of 5/8" garden hose to the threaded fitting on the main rails (not necessary at Egegik, Ugashik, or Naknek). Check for stones lodged in the ends of hoses, fittings, valves, etc. and for breaks or cuts in the hoses.

The last step in the process involves a thorough washing of the transducer faces with dishwasher detergent. Do not use an abrasive cleaner, steel wool, or a scouring pad. Wash the faces thoroughly and leave the soap on the face of the transducers. This will protect the surfaces from any oily contact with human skin or other source, and will be washed off when the gear is placed in the river. Any oil on the transducer face will interfere with the thorough wetting of the PVC and may cause air bubbles to cling to the surface resulting in improper transducer function.

Measuring River Bottom Profile

Then measure the river bottom profile at your sonar site with a Lowrance depth sounder or by sounding depths every 10 ft along the tag line and measure the depth to the nearest 0.5 ft. Record and map the bottom profile results on the bottom portion of the Array Distance and Bottom Profile Form (Appendix C.3 to C.6) with the appropriate width and depth for each point measured.

Placing Array Anchors

The arrays should be placed in a straight line extending from the sonar tent frame to a point directly across (at right angles to the current) the river. Desired array locations for each smolt sonar project are shown in Figures 10-13. Before placing each array anchor, attach a line and an orange buoy to each. Then place and set each array anchor so that the buoy line trailing from the anchor passes through the desired array location on your tag line. The anchor line can then be lengthened or shortened to obtain exact array placement. A line attached to the center of each array tube will mark the location of each sonar arrays for other river traffic and enable you to adjust and/or retrieve each array in the future.

At the Kvichak sonar site the offshore array anchor is permanent. It can be identified on the river bottom by a long yellow polypro line that is attached to the anchor. Upon locating the line grab it with a pike pole and attach a buoy to it. If the offshore anchor has moved during the winter, you may need to add to or reduce the scope on the anchor line to align the offshore array. Kvichak's inshore and center array anchors are temporary and are set as indicated above and pulled each season.

Submerging Arrays

As of 1994, all eastside smolt projects have cut off the caps on the ends of their arrays and/or drilled holes at random intervals along each array to allow them to fill completely ʏ .h water and sink by themselves. The prior system of submerging arrays using a ubmersible electric pump and rubber garden hoses to pump water into the arrays and sink them is no longer employed.

Kvichak, Naknek, and Egegik

The arrays are now ready to install. Start with the inshore array. Position the array across the mid-section of the boat with hose couples over the left side and the bridle towards the stern. The box with the cable bundle should be positioned somewhere forward of the array. The coiled rubber hoses should be attached to the arrays and placed where they will be out of the way and remain untangled. The bridle should be attached to the snap hooks on the array.

Other equipment needed in the boat are pike pole. Two-to-three people are needed (including boat operator) to complete this task. Approach the location from below, then grab the anchor line buoy, attach the bridle to the anchor line, detach the buoy, and make certain there are no kinks.

The array is carefully slid off the front of the boat into the water so that the transducers do not bang against anything as the array slides off.

Ugashik

The Ugashik arrays are attached to the anchor lines which are pulled to shore. The arrays have holes drilled in them so they can be set in the water from the right bank and pushed out into the current. Pull on the anchor lines to make sure they are positioned and set properly.

Pull lines are attached to the anchor lines about 100 ft up from the arrays (before the arrays are attached) to aid in positioning the arrays. The pull lines can be tied off to a sturdy stake on the left bank to hold the arrays in position. At Ugashik, the offshore array must be set first.

Laying Out Transducer Cables

The next step for all projects involves feeding the cable bundle over the gunnel as the boat moves toward the tent housing the control unit. This should be in as straight a line as possible so that the bundle won't interfere with the setting of the remaining two arrays.

Small anchors rigged with 10 ft lines and snap hooks are attached to the cable bundle rope (not to the wires) to eliminate some of the drag on the cable bundles as they rest on the bottom. A stake at the shoreline in front of the same tent is used to tie off the cable bundle ropes to prevent them from being pulled back out by the current. The remaining arrays are deployed in their respective locations in the same manner as the first except that special care is taken to position each succeeding bundle as close to the preceding one without crossing or placing anchor lines over the previously laid cables. The cables are then strung into the tent where they can be connected to the control unit.

Following the placement of all arrays, a visual check is made of the system for proper alignment and to make sure that cables, ropes, etc. are not crossed over the face of any transducer. Final adjustments are accomplished with the aid of a pike pole (or preferably, buoy line attached to the downstream center of the array) taking care not to hang up on electronic cables or transducers. The safest point of attachment on the arrays is the bridle cable immediately ahead of where it attaches to the main tank.

The next step involves the protection of the transducer cable bundles where they exit the river and enter the tent. Carefully excavate a trench along the river bank and bury the cable bundles in it. This will protect the cables from boats, foot traffic, ice scour, etc. Additional protection from heavier ice scour can be provided by piling large rocks on the bank just upstream from the cables. Place this far enough upriver so that if the rocks are pushed over by ice they will not roll on top of the cables, but will still tend to break up or deflect large chunks of ice away from the bank.

Measure Array Distances

After all arrays have been set (2 at Ugashik and 3 at all others), measure the distance from the river bank where the smolt tent is located to the center of each array to the nearest foot and record the information on the top portion of the Array Distance and Bottom Profile Form (Appendix C.3 to C.6).

Measuring Water Velocities

Then measure water velocities above each array with a Gurley flow meter[2] at the surface, 2 ft, and 4 ft below the surface. The surface flow meter reading should be taken with the top of the flow meter cups completely submerged. At each array, flow meter readings should be measured at each depth three times for 60 seconds each time and recorded on the Velocity Reading Form (Appendix C.7 to C.10).

To convert the flow meter readings (clicks/60 sec) to velocities (ft/sec) on the Velocity Reading Form do the following:

1. Calculate the average of the three flow meter readings for each depth at each array.
   e.g., Inshore Array, Surface AVG = (Surface #1 + Surface #2 + Surface #3) / 3
   This produces an average flow meter reading (clicks/60 sec) for each depth.

2. Sum the surface, 2 ft, and 4 ft average flow meter reading for each array and divide this number by 3.
   e.g., Inshore Array AVG = (Surface AVG + 2 ft AVG + 4 ft AVG) / 3
   This produces an average flow meter reading (clicks/60 sec) for each array.

3. Convert the units of the average flow meter reading for each array from (clicks/60 sec) to (revolutions/60 sec). How you accomplish this step depends on what model flow meter you are using.

   a. Gurley, Model 622 flow meter - multiply the average flow meter reading (clicks/60 sec) for each array by 5 to convert to revolutions/60 sec.
      e.g., (Inshore AVG) * 5 = n revolutions/60 sec

   b. Gurley, Model 625 (Pygmy) flow meter - multiply the average flow meter reading for each array by 1 to convert to revolutions/sec.
      e.g., (Inshore AVG) * 1 = n revolutions/60 sec

4. Convert the units of the average flow meter reading for each array from (revolutions/60 sec) to a water velocity (ft/sec). Again this conversion depends upon what model flow meter you are using.

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2 To comply with the optimum operating ranges of these instruments use the Gurley, Model 625 (Pygmy) flow meter for measuring water velocities less than 3.0 ft/sec and use the Gurley, Model 622 flow meter for water velocities greater than 3.0 ft/sec. See your field manual for the manufacturer's instructions on how to use these flow meters.

a. Gurley, Model 622 flow meter - subtract 100 from average array flow meter reading in revolutions/60 sec, multiply the difference by 0.37, add the product to 3.71, equals water velocity in ft/sec.
e.g., [(revolutions/60 sec - 100) * 0.37] + 3.17 = n ft/sec

b. Gurley, Model 625 (Pygmy) flow meter - divide the average array flow meter reading in revolutions/60 sec equals water velocity in ft/sec.
e.g., (revolutions/60 sec) / 60 = n ft/sec

The water velocity from the index array will then be used to establish the water velocity correction factor.

At Naknek and Egegik the index is the reading taken from the constantly operating flow meter. A reading from that must be taken at the same time as the velocities behind each array and a correction factor calculated for each array.

Electronic Hookup

After the arrays are installed, the electronics can be hooked up. The control unit should be positioned up off the floor of the tent at a comfortable operating height. The unit should never be operated without protection from rain or weather.

<u>Before attaching the transducer cable plugs, make sure that the power is disconnected from the sonar control unit</u>. Each transducer cable is individually numbered. Matched up and connected each numbered cable to the jack on the control unit box with the same corresponding number. Be sure each plug is dry and clean. The weight of the cable bundle should be supported by the tent frame to take the strain off the plugs to prevent breaking the wiring loose at the connector. Make certain that each cable connector has a snug fit. If the connectors have been bent during the handling, they can be easily adjusted with needle-nose pliers.

GEAR OPERATION AND MAINTENANCE

Power Supply

The system is powered by a single 12-volt automobile battery recharged by a pair of solar panels. Figure 14 shows how to wire the power supply for the smolt counter. A special circular power cord is provided for connecting the battery and solar panel to the control unit. The terminals of the battery should be thoroughly cleaned before attaching the clamps. Although the unit has reverse polarity protection, care should be taken to ensure that the polarities are exactly as labeled on the cable clamps.

If the circular power cord with the battery clips is missing and alternate connection can be made using a double-pronged banana plug, a twisted length of black and red wire, and two battery clips. Plug the double-pronged banana plug into the two holes marked *scope power*, then connect the red and the black wire to separate battery clips, and then attach the red battery clip to the positive terminal and the black clip to the negative terminal on the 12-volt battery.

After the control unit is connected to the battery, the battery condition meter on the control panel should register about 1/2 inch into the green part of the scale in order to operate properly. <u>If the battery meter on your control panel does not produce a reading</u>, either your battery is dead or you have wired your battery backwards and you need to switch your battery connections (e.g., red to "+" and black to "-").

If the face of the meter requires cleaning, do so only with a cloth moistened with alcohol or mild detergent. If a dry rag is used, static electricity will develop on the glass and interfere with an accurate reading of the indicator needle.

Periodically check the battery terminal clamps to make certain they haven't been jarred loose. A loose battery clamp may cause intermittent false counts whenever it is moved slightly on the terminal. For this reason, Al Menin now recommends that all battery clamps should be replaced by lugs which can be screwed directly to the battery terminals.

The solar panels used at all smolt projects are 43 watt, 2.9 amp Atlantic Solar Power, Model M-65. Ultimately we would like each solar panel to be equipped with a voltage regulator (Model M-4-12V). Solar panels equipped with regulators prevent overcharging by not allowing the voltage to the battery to exceed 13.5 volts. Figure 15 shows how to wire a voltage regulator for a solar panel. Solar panels should be wired with red (+) and black (-) size 12 or 14 house wire. WARNING: DO NOT WIRE AN ACTIVE SOLAR PANEL

TO A REGULATOR WITHOUT FIRST ATTACHING THE BATTERY LEADS -- you may overload the unit!!!

Without a voltage regulator, a solar panel with an open circuit and no load can produce 22 volts and cause a battery to boil. If you have a solar panel that is not equipped with voltage regulators, be sure to monitor your battery condition meter during extended periods of sunny weather to prevent your battery from boiling. Should the battery condition meter creep above the 1/2 inch point on the green scale, disconnect the solar panels from the battery to prevent it from boiling and becoming permanently damaged. Overcharging the battery can also produce false counts on the smolt counter.

What to do if your smolt counter is overcharged by the solar panels during and extended period of sun shine: Your smolt counter may exhibit some of the following symptoms: 1) You may have problems resurfacing your transducer signals. The red lights may not light and therefore you can't tell where the surface is. 2) The battery condition meter starts reading high. You disconnect the solar panels, however the battery condition meter continues reading on the high end of the scale. If your smolt counter is exhibiting the above symptoms you should disable the smolt counter and disconnect it from all power supplies for a period of 1-2 minutes. Occasionally, when the smolt counter is overpowered, its internal computer will lock up and depowering the system will allow it to reset itself. Then reconnect the system and reactivate the smolt counter. In most cases, this will solve your problems and the smolt counter will resume functioning properly.

Bad Power Supply Card. However if the system still does not function properly after depowering, you may have a bad power supply card and it will need to be removed and replaced. Contact your project leader immediately and he will send you a replacement power supply card from King Salmon. The power supply card is located in Slot #1 of your smolt counter. When the new card arrives, remove the old card from slot #1, and insert the new power supply in the same slot per your project leaders directions.

Solar panels should be cleaned periodically to insure they are operating at optimum efficiency. Solar panels which are working correctly should put out 3.5 to 4.0 amp in full sun light. On overcast days the same solar panels may only put out 0.25 amps. Therefore if the battery condition meter begins to drop off during periods of overcast weather, keep your backup batteries fully charged and ready to go. And be prepared to recharge your batteries on your portable gas powered generators.

Al Menin also recommends that you wire your solar panels through your control unit. The solar panel provides enough power to operate the control unit and allows you to change the battery without losing power. However be sure to change your battery between print intervals because the solar panel does not provide enough power to operate the printer. With this hookup you can also monitor how well your solar panels are working by switching the toggle on the control unit just to the right of the meter. If the solar panels are working correctly their output should drop whenever the sun is covered by a cloud.

Setting Printout Interval and Timer

Unless otherwise instructed, the printout interval for the printer should be set be set at 30 minutes. If the printout interval is changed (e.g., 7.5 min, 15 min, 30 min, or 60 min) at any time, it should be done immediately after a print time. If the printout interval is changed in the second half of any given interval, it won't adjust the time until the next printing.

The Bendix, 1982 Model sonar counters used at Kvichak River (Serial No. 8282300001) and Ugashik River (Serial No. 8320004) have been modified to print at shorter printout intervals than 7.5 minutes. During periods of high smolt passage, the Kvichak counter can be set to printout at 1.875 minute or 3.875 minute intervals.

The 3-way switch that allows these different printer interval printouts has three settings:

left - 1.875 minute printout interval (every 1 min 5.25 sec)
center - off (In the "off" position, the printout interval dial controls the printout interval (7.5, 15.0, 30.0, or 60.0 minutes)).
right - 3.750 minute printout interval (every 3 min 45.0 sec)

Whenever you use the 1.875 or 3.750 minute switch, be sure to record the selected printout interval on the paper tape printout. When activated, the new switch will override the "printout interval dial", however the printout will still indicate whatever interval was set on the "printout interval dial". When first activating the printer at the 1.875 minute print interval, the first printout will occur at 1.500 minutes. Thereafter, printouts will occur at that set time. Regardless of what printout interval you have set or the number of times you have changed it, all hourly printouts will be accurate.

Shorter printout intervals will use more printer paper. Be sure you have enough paper before switching to shorter print intervals for extended periods of time.

The timer in the control unit is an accurate quartz crystal type and shouldn't require resetting again after the system is placed in full operation.

Printer

All eastside smolt projects currently use Datel Intersil (Model DPP-Q7) Printers. In addition to the four printers which are assigned to specific projects (Kvichak, Naknek, Egegik, and Ugashik) there are also one spare printer in each of the two black plastic smolt component suit cases. These spare smolt component suit cases are stored in the smolt closet in the warm storage building in King Salmon.

Printer Paper

Printer paper (#32-2242570-Datel) comes in boxes of 10 rolls at 130 ft of paper per roll. This paper can only be ordered from Datel, Inc. at (508) 339-3000. The supply of this paper is kept in the smolt closet in the warm storage building in King Salmon.

Each smolt project will typically use 3-4 rolls of printer during the course of a one-month smolt season, however start out with at least 6 rolls.

<u>To change printer paper</u>, unlock the knob on the printer by turning it to the left. Pull the printer assembly out. Look how the paper is threaded before you remove the old paper roll. Press the wire tab on the side to unlock and remove the old paper roll. Pull the old roll out. Thread the new roll of paper the same way as the one that was just removed.

When <u>removing printer paper</u>, don't force the paper when you pull it out, it will strip the gears and cause irreversible damage to the printer. To avoid damaging the printer, unplug it, release the paper lock, then pull the paper out on the left side.

Post-Season Storage and Pre-Season Check of Printer

When the printer is not used for long periods of time, a flat spot can develop on the soft rubber roller and cause printer malfunctions. To avoid this problem, at the end of the field season pull the roller back and install a wide rubber band to keep the roller separated from the print mechanism. This will prevent the characteristic flat spot from developing on the roller. At the start of the next field season, be sure to look for and remove this rubber band from the print roller. The printer will not function with the rubber band in place.

Printer Card

In the event that you have to check or change the printer card in the smolt counter, the card which controls the printer is located in Slot #5. Proper hookup directions are noted on the 24 gauge teflon coated wire bundle that is connected to this card. Before removing the old card, note the position of the colored wires on the connector and the row of the connector on the card body. Be careful not to bend any of the pins on the back of the printer card when handling it.

Velocity Settings

The velocity setting determines the ping rate or the rate at which the transducers fire which greatly affects the accuracy of the counter. The control unit should be set to the velocity recorded over the index array. The index array for each smolt project are as follows: Kvichak - center array, Naknek - separate flow meter on an anchored buoy, Egegik - center array, and Ugashik - inshore array. Changes in the velocity setting on the Naknek and Egegik control unit should be made after every 30-minute period due to the constant changes produced by tidal influences. At Kvichak and Ugashik, where there are no tidal influences and the water velocities are more constant, velocity setting are changed every 5-to-7 days when new velocity readings are measured.

Calculating Water Velocity Correction Factor

The water velocity correction factor is set based on the water velocity over the index array. On all Bendix, Model 1982 and Model 1983 smolt sonar control units the water velocity correction factor is entered on the RIVER VELOC adjustment in sec/ft (spf).

The water velocity correction factor (V_{cf}) can be derived by converting the water velocities over the index array from ft/sec (fps) to sec/ft as follows:

$$V_{cf} = 1 \; / \; fps = spf$$

This equals the water velocity correction factor in sec/ft.

At Kvichak the water velocity correction factor equals 1/fps over index (center) array. Take new water velocity readings with the Gurley flow meter every 7 days and change the water velocity correction factor on the control unit whenever the velocity readings change.

At Naknek the water velocity correction factor equals 1/fps over index buoy, located directly downstream of the inshore array. Because of tidal influences at this sonar site, take new water velocity readings on the fixed Gurley flow meter every 30 minutes and change the water velocity correction factor on the control unit whenever the velocity readings change.

At Egegik the water velocity correction factor equals 1/fps over index (center) array. Because of tidal influences at this sonar site, take new water velocity readings on the fixed Gurley flow meter every 30 minutes and change the water velocity correction factor on the control unit whenever the velocity readings change.

At Ugashik the water velocity correction factor equals 1/fps over index (inshore) array. Take new water velocity readings with the Gurley flow meter every 7 days and change the water velocity correction factor on the control unit whenever the velocity readings change.

Depth Settings

As the water level in the river changes, icebergs flow down river, or the wind causes waves on the surface, readjust the listening range (depth) of each array. These changes are made after every 30-minute printout and whenever necessary to avoid false counts.

The arrays are resurfaced by first disabling the system and unlocking the depth setting dials (raising the lever on the right-hand side of each dial unlocks it). The depth setting is increased until the totalizers begin registering counts and/or the LED's begin to light. When slowly raising the depth setting to locate the surface (or bottom of icebergs) you will notice that the LED's will begin to light before the totalizers start counting. Because the LED's are more sensitive, it is preferable to use them in locating the surface. Lower the depth settings <u>two-to-five hundredths</u> below this point. Lock the depth setting, turn the system back on, and record the surface depth and the surface depth on the Sonar Adjustment Log (Appendix C.11).

If you do not disable the system when you resurface the arrays be sure to record the time, the number of false counts that result, and the reason for the false counts (e.g., resurfacing) in the Sonar Adjustment Log.

Each array has an inshore and offshore depth adjustment to permit the electronic leveling of the arrays in situations where an array is resting on an uneven bottom. If there were only a single adjustment for each array, the depth setting would be determined primarily by the shallowest transducer.

If the depth of a given array fluctuates frequently, air bubbles may be present in the array tanks or debris may be collecting on the array. Both of these scenarios may cause the array to partially float off the bottom. If this occurs you need to determine what is causing the array depth to fluctuate and act accordingly. If the problem is caused by air bubbles, you may need to lift one end of the array with a pike pole to allow the air to escape through the one-way valves or pump additional water into that array to displace the air. If the problem is caused by debris you need to remove it.

Limited smolt school passage data suggest that the depth of smolt passage may vary diurnally. During daylight hours smolt schools tend to travel at greater depths below the surface than during darkness. Therefore, during daylight hours you can dial the depth setting of your counter down (due to wind, rain, etc.) without missing many smolt. However when your depth setting is dialed down at night due to bad weather, you are probably missing smolt.

All Bendix, Model 1982 and Model 1983 smolt counters have a variable (dial controlled) *dead depth* or *blanking range*. Do not dial your dead depth down below 1 meter. Below 1 meter, you may pick up transducer ringing with resultant false counts. The dead depth dial is on the bottom right of the smolt counter. Always leave it set on 1 meter.

Calculating Average Depth and Velocity by Date

The average depth of water over each array and the velocity (based on the most current Gurley flow meter reading) over each array needs to be calculated each smolt day as follows and recorded on the Average Depth and Velocity Data Entry Form (Appendix C.12 or C.13):

1. Average Water Depth per Array per Smolt Day

   a. *Water depth over arrays* are taken from the resurfacing figures recorded on the Sonar Adjustment Log. Use the depths that the machine was set (not surface). Kvichak, Naknek, Egegik, and Ugashik depths are measured in meters (nearest 0.01 m).

   b. *Water set depths* (from Sonar Adjustment Log) for the inshore half and offshore half of each array should be averaged each hour and recorded under the appropriate time and array column on the Average Depth Setting and Fish Passage Form (Appendix C.14 or C.15).

   c. By smolt day (1200 hours one day to 1159 hours the next day) add all the set depths for each array. Then divide by the total number of set depths for each array per day. Thus you have an *average set depth for each array by smolt day*. See your project's Data Forms Notebook for an example of how to complete this form properly.

2. Velocity Over Arrays by Smolt Day

Velocities are calculated from Gurley flow meter readings recorded in the Velocity Reading Form. The average velocity (for all depths and repetitions) per array for each smolt day is recorded in ft/sec on the Average Depth and Velocity Data Form. Because Gurley readings are only taken every 5-to-7 days, velocity entries will be the same for consecutive days until a new velocity reading is taken. The velocity entry recorded for the index array should be the same as that recorded for the inshore array, if you are using the inshore array to set your smolt counter.

False Counts

Smolt counts tend to be in "bursts" over one or two arrays. False counts due to wind, rain, snow, ice and boats tend to cause a streaky pattern of counts over all arrays. It is difficult to estimate the number of these counts and later subtract from the counts registered by the printer. Therefore it is better to disarm the control unit before it registers false counts (e.g., boat traffic, floating debris, ice flows, strong winds, white capped waves, or heavy rains) and interpolate counts for disabled time. False counts caused by less severe conditions (e.g., lighter winds, persistent drizzle, slight waves action, etc.) may be solved by lowering the depth setting on the control unit to prevent false counts. See instructions for Sonar Adjustment Log in your Data Forms Notebook.

False counts can also be caused by other electronic equipment operated in close proximity to the smolt counter. For example, the Egegik crew has observed that when the battery for the Gurley flow meter is placed near the counter that false counts are generated when the Gurley flow meter is hooked up to the battery to take water velocity measurements. Other crews have reported that false counts are generated when they key the microphone for radio transmissions. False counts from radio transmissions can be eliminated by using a separate 12-volt battery for the radio (e.g., don't hookup the sonar counter and the radio to the same battery). If these false counts can't be eliminated by changing the location of other electronic equipment or their battery sources, be sure to note the time, number, and source of the false counts in your Sonar Adjustment Log each time they occur so that they can be factored out of your hourly and daily sonar counts.

Troubleshooting the Sonar System

After gaining a familiarity with the system's construction and operation, you should then be capable of detecting obvious problems with the proper functioning of the units. Some are easily reduced by a minor adjustment while others may require electronic repairs by a sonar technician.

Immediately after installing the arrays and transducer cables in the river check the system to make sure that no cables, lines, hoses, etc. have drifted over the transducer faces. Sometimes intermittent or continuous counting on the control unit totalizers are a sign that something has drifted in front of one or more transducers. Should this occur, remove the obstruction.

If counts persist after this, depth adjustments should be checked to determine if the problem is due to a floating array (still partially filled with air). A floating array will cause intermittent counts, but only on the first few transducers nearest the surface on the water.

Loose connections, where the cables plug into the control unit, should be checked next as a possible cause of the problem. Make sure that the male and female portion at each connection is clean, dry, and not bent. Replace all corroded plugs.

If counts still persist after making all obvious adjustments, a ringing or otherwise malfunctioning transducer may be the cause of the problem. The only way to identify a ringing transducer is with the use of an oscilloscope (to be discussed later). If a ringing transducer is located, it is best to disconnect this transducer. <u>If a transducer is disconnected, record the time, date, array, transducer number that was disconnected, and why on the Sonar Adjustment Log</u> and notify your project leader about this as soon as possible. Your Sonar Adjustment Log note will alert the project leader to expand the effected sonar counts in proportion to the number of disconnected transducers. If the system has to be raised in order to replace transducers, it is only necessary to remove the bad transducer and replace it with a new one.

Spare electronic circuit cards are included inside the control box, but should not be replaced except by sonar technician Al Menin or under the direct supervision of the project biologist. A totalizer that counts continuously and becomes progressively worse, for instance, may be malfunctioning due to a faulty receiver card (which can be replaced by a spare). Although it is possible to replace a receiver card without turning the power off, it is advisable to cut the power before working inside the unit. The cards are inserted in a precise way and will be damaged if they are reversed.

If the depth setting is raised all the way to its maximum, all of the LED's should light. This is also a standard test of the system.

Recording Counts and Handling Data

Assuming there are no false counts, all that is required in handling sonar count data is to periodically remove the printer paper and total the hourly counts for each array. Multiplying these totals by a velocity correction factor, a fish/count factor, and a river expansion formula provides a total estimate of numbers of smolt migrating to sea per day. Unfortunately, the situation is never that simple.

The most important task required of the operator in monitoring the system involves the meticulous keeping of the Sonar Adjustment Log (Appendix C.11) and Average Depth and Velocity Data (Appendix C.12 or C.13). In addition to recording false counts, these logs are also a valuable reference later for piecing together events at the sonar site during any given day. They verify the time intervals during which the system was disabled and comment on the sources of false counts. They also provide a chronological record of changes in ice condition, water depth and water velocity as the season progresses. See instructions for Sonar Adjustment Log in the Data Forms Notebook.

The used portion of the printer paper is removed from the unit in sections corresponding to crew member work shifts (e.g., every 8 h) each smolt day. Upon removal, the paper tape is immediately labeled with the date (mm/dd/yy) and the hours that are included it. Remember that the hours are numbered from the bottom up. Data which falls on the hour is included in the 60 min preceding (counts occurring after the 0900 hour printout and recorded at the 1000 hour printout are recorded in the 0900 hour count on the Daily Sonar Log).

Tape Label:	Project & Year	- Egegik 1994
	Page No(s)	- p. 14
	Smolt Day	- 6/3-4
	Hour(s)	- 1800-2400
	Your Initials	- FT

After the paper tape is labeled, it should be clipped to the corresponding Daily Sonar Log and filed away in a safe place.

At the end of each smolt day (from 1200 hours to 1159 hours the next calendar day) the daily outmigration is calculated on the Daily Sonar Log (Appendix C.16 or C.17). With the exception of the velocity and fish per count correction factors, all entries necessary to compute the daily outmigration are taken from the printer paper tapes and Sonar Adjustment Logs for that day. Record actual sonar counts, false sonar counts, and adjusted sonar counts on the Daily Sonar Log. Also record disable time and the page of the corresponding Sonar Adjustment Log on the Daily Sonar Log. Each operator should initial the hours he recorded. When recording data in the Daily Sonar Log, all subtraction and addition calculations should be repeated twice as a check).

Once the daily adjusted sonar counts have been tallied for each array, and corrected for river velocity and the calculated smolt per count value (see below) they become the expanded counts (labeled EC_I, EC_{II}, EC_{III} for arrays I, II and III, respectively). These expanded counts are divided by the 11 ft of river width ensonifed by each array and are entered in the appropriate place in the equations on the back of the Daily Sonar Log to used to calculate number of smolt per river section. Finally, the four areas under the curve are summed to generate the Daily Outmigration Estimate.

The sonar system is designed to register a single count for the equivalent of five smolt, each weighing 8.29975 g (a biomass equivalent of 41.498 g). Since the size of smolts varies throughout the season, in post-season calculations it is necessary to determine a pooled-mean weight each day for smolt of all species and age classes captured during that day of fishing. This is calculated for each daily sample as follows:

[(proportion age-1. sockeye smolt) x (mean weight age-1. sockeye smolt)] +
[(proportion age-2. sockeye smolt) x (mean weight age-2. sockeye smolt)] +...
[(proportion age-Z coho smolt) x (mean weight age-z coho smolt)] = pooled mean weight.

The pooled mean weight is divided into 41.4988 g to calculate the estimated number of smolt per sonar count for that day. This factor is then used to calculate expanded count values (see above).

Post-season the sonar counts are combined with the species and age class data obtained from samples taken during the corresponding sampling period with the aid of computer programs. Each sampling period must contain a total of 600 smolt which have been aged (see Age-Weight-Length section below). Combine daily samples, if necessary, until at least 600 smolts are included. This age and species data will then be used to apportion daily sonar counts during the corresponding time period.

All completed forms and notes are to be stored in a safe place.

Oscilloscope Operation

Final verification of correct electronic functioning of the hydroacoustic system can only be accomplished with an oscilloscope. A dual trace Tektronix oscilloscope (Figure 16) is available for testing the equipment.

As in the case of the sonar electronics, the oscilloscope is a highly sophisticated piece of equipment and must be handled accordingly. The crew leader will be responsible for setting up the oscilloscope following the project leaders instructions outlined in this manual. Thereafter the oscilloscope can be used to test individual transducers.

The oscilloscope may be powered by an internal 12-volt-DC battery pack, a standard automobile battery, or by the same battery that powers the hydroacoustic system (Figure 17). The internal battery is handy for remote operation of the oscilloscope where transportation of a heavy auto battery is awkward or impossible. <u>The oscilloscope should be grounded to the sonar control unit when using the internal battery</u>.

The most frequent use of the oscilloscope to test the system is for examination of the electronic pattern of the individual transducers.

Testing Transducers

The procedure for conducting the transducer test is as follows:

1. Connect the oscilloscope to either external or internal power. If external power is used, be certain that the correct polarity is observed by matching up the red and black plugs on the special connector cables to the same colors on the oscilloscope jacks.

2. Next, turn the **Power** toggle switch on the oscilloscope to the "on" position. It will take several seconds for the oscilloscope to warm up.

3. Meanwhile, set the **Trigger** knob to the pencil mark on the dial. "**Channel 1**" should be pushed in and "**Norm**"" buttons should be out. If using an external battery, the "**Ext. DC**" button should be in and the "**Internal**" buttons out.

4. Set the channel 1 **Volts/Division** dial to 0.5 or 1.0 depending on the desired height of the pattern.

5. The **Time/Division** dial should be set at .2 which is equal to 0.5 ft per division on the oscilloscope. A setting of .1 will equal half that or 0.25 ft per division on the oscilloscope screen.

6. The "**Vertical**" and "**Horizontal**" knobs are variable and are used to position the image on the screen in relation to the vertical and horizontal lines.

7. The **Red** knobs in the center of several dials are special calibration adjustments and should all be turned clockwise as far as possible.

8. One probe is connected from the channel 1 "**Vertical Input**" jack on the oscilloscope to the desired transducer jack on the control unit (green).

9. The second probe is connected from the "**External Trigger**" jack on the oscilloscope to the desired "**Oscilloscope Trig**" jack on the control panel (yellow or red).

10. If grounding is required, the black-colored jack on the control unit is used for this purpose.

Note - Ugashik Smolt uses a different make and model oscilloscope. See their field manual for particulars of their oscilloscope operation.

Scope Patterns

If the oscilloscope is set up properly and the transducer is operating as designed, the scope pattern should resemble that of Figures 18 or 19. If no smolt are passing and there is very little subthreshold interference in the water, the scope pattern will look like Figure 18. The lack of echo in the trace indicates there is nothing passing through the beam which is detectable by the transducer. The scan of the transducer is from left to right so that the surface of the water is to the extreme right. If the range is extended out, the surface is represented by the sharply peaked line on the screen. When smolt are passing through the transducer beam, they will register as illustrated in Figure 19. The smolt were concentrated at mid-water and were detected halfway through the listening period of the transducer. The signal from entrained air will also resemble this pattern, but the experienced operator will learn to distinguish between the two signals by differences in location of traces within the water column and in the way signals start and end.

Ice, on the other hand, will always produce a signal at the extreme right hand end of the line since the ice will always float on the surface of the water.

A brief scope test of all transducers should be done at least every other day to check for weak or dead transducers. The test and results should be noted in the adjustment log each time it is done so the project leader can document when transducer problems are first detected. This information is used post-season to adjust the final sonar counts.

A weak (reduced vertical range) surface pattern is the most obvious sign of a transducer problem. If this is noted, have someone run a boat upstream of the array and note whether or not the LED for that transducer is lighting as often as the others. Another good check is to dial up to the surface and see if the questionable transducer starts counting at the same point as its neighbors. Note that a diminished surface pattern is not always indicative of a bad transducer. Especially on a tilted array. A transducer that is not quite straight in its mount will hit the surface at too great an angle to produce a good surface pattern, but will still count smolt OK. This is why the boat test is necessary in combination with the scope testing. Weak transducers must be unplugged because we have no way to quantify how well they are counting.

Probe Test

To test the probes, attach them to the normal contact location and touch the probe point to the 5 v. cal. ground. This should produce a square-wave pattern on the oscilloscope screen as illustrated in Figure 20.

Recording Vertical Distribution of Fish Passage

Monitoring for vertical distribution of passing smolt schools should occur during the peak two weeks of smolt passage.

The vertical distribution of smolt will be monitored with the oscilloscope for approximately one hour a day by each person on their shift. <u>Spread you hour of monitoring throughout your shift and among all arrays</u>.

Record the depth of smolt passage on the Average Depth Setting and Fish Passage Form (Appendix C.14 or C.15). Information which must be recorded include: date, time, depth settings by array and the top and bottom depth of passing smolt schools by array.

To determine the water depths represented by each graduation on the oscilloscope, first adjust the surface of the oscilloscope pattern to the top of one graduation. Then dial the depth down on the control unit until you see the top of the listening period drop to the next oscilloscope graduation. The distance dialed down represents the depth per graduation.

We are interested in identifying the top and bottom depth of the smolt schools as they pass through our transducer beams. Therefore concentrate on the scope and record the top and bottom point of fish passage (e.g., if each graduation represents 0.5 m and the smolt school could be detected from the surface through 3 graduations, then the depth of passage would be 0.0 m to 1.5 m below the surface).

Troubleshooting the Oscilloscope

If the oscilloscope fails while in operation, and a check of all connections and adjustment knobs show everything to be in order, the safety fuse should be replaced. Spare fuses are located inside of the oscilloscope carrying case. If you use this fuse or discover that you do not have a spare, please note the fuse size (e.g., amps) needed for the oscilloscope and relay this information to your project leader so that he can order a replacement.

GEAR RETRIEVAL AND STORAGE

Removal of the gear from the river at the end of the season is basically done in the reverse order of the installation process.

Final Oscilloscope Test of the System

A final oscilloscope test of the system for faulty transducers should be done to determine whether repairs are needed before next season. Identify and record all transducers which aren't operating at full strength at this time.

Disconnecting the Electronics

After turning the system off and disconnecting the battery, the transducer cables are unplugged from the control unit. This is done by grasping and pulling on the steel portion of the plug rather than on the wire. The cable bundles are then removed from the tent and placed in their storage box. The box is then loaded aboard the boat in preparation for retrieving the system.

Retrieving the Arrays

Following the installation instructions in reverse order, the cable bundle is gradually collected aboard the boat, and the transducer array is raised one at a time by hand. Each array is then lifted into the bow of the skiff, disconnected from the bridle line, and brought ashore. At Ugashik, first release the pull ropes on the inshore array and then pull it back to shore. Then follow the same procedure for the offshore array.

Disassembly

Once on the beach, the cable bundle should again be extended to its full length and detritus removed from the ladder arrays. During this step, each transducer should be individually shaken to determine whether water has leaked inside. <u>Any leaky transducers or bad transducers should be replaced at this time</u>. Clean the cable bundles after they have dried and examine each cable for signs of damage. Flag all sections of cable which need repairs and note specifics of repairs needed (e.g., Inshore Array, transducer #1, 3 abrasions and 1 cut flagged on cable, needs repair) in your crew report.

After the transducers have been removed from the arrays, the array tanks should be tipped up to remove all water from the array. This will lighten the load and also prevent breakage from freezing during the winter. The cross-member sections of the arrays should be flushed with water to remove sand and rocks that have accumulated during the season and drained before storage. Numbers painted on the sonar arrays should be darkened with an indelible black felt pen, if they have been rubbed off during the season.

Equipment Repairs

If time permits, preform all sonar equipment repairs before returning them to the warm storage building in King Salmon. If the necessary repairs can not be completed, be sure to note them in your crew report and bring them to the project leaders attention.

Final repairs to the fyke net should also be preformed before returning it to storage at the end of the field season. If fyke net repairs are not or can not be completed, be sure to note the exact details of your fyke net needs in your crew report and bring them to the project leaders attention.

Other equipment items needing repairs should be clearly labeled (e.g., your projects name and the details of the problem or repairs needed), stored in an easily accessible location, and inform the project leader about the needed repairs.

Storage of Equipment

Before you begin boxing up your equipment for shipment and storage in King Salmon, take one last look at your current year equipment inventory and make sure that it is complete. Be sure to identify all items which were lost, damaged, or need to be repaired or replaced prior to next field season. Again follow the format on the Equipment Inventory Form (Appendix C.1) and provide as many details (e.g., make, model, part nos, dimensions, etc.) as you can to insure that the repaired or replacement item will satisfy your needs next year.

The plastic array ladders can be left intact and stored in the same location where they were found at the start of the project. *The Kvichak arrays are stored at Igiugig in the back room of the shop building. The Naknek arrays are stored in the cold storage warehouse at King Salmon. The Egegik and Ugashik arrays are stored in the back room of their respective cabins.*

Be sure that all boxes and equipment items from your project are clearly labeled (e.g., Kvichak Smolt - smolt counter, Kvichak Smolt - solar panel, Kvichak Smolt - inshore array, transducer bundles, Kvichak Smolt - 2 spare transducer, new).

The boxes of transducers, transducer cables, and all electronics <u>must</u> be returned to King Salmon for placement in dry and warm storage. Care should again be used in transporting the cases back to town.

In King Salmon adhere to the following guidelines when you store these equipment items:

1. Gas hoses need to be drained and stored in the drawers in the shop below the wire tags.

2. Ammo cans (boat boxes) need to be dried and sprayed with WD-40 lubricant. All tools in the box should also be dried and sprayed with WD-40 before being put back into the ammo box. To prevent moisture condensation in the box over the winter, leave the lid of the box cracked open.

3. Return fire arms, ammunition, and gun cleaning kits to the gun cabinet in the King Salmon office lab.

4. Store all of the following in the warm storage building as indicated:

   a. First Aid Kits - on the shelves on the outside wall of the walk-in freezer
   b. Fire Extinguishers - by the upright freezers as you enter the warm storage building.

c. SSB Radios and Antennas - on the shelves on the outside wall of the walk-in freezer

AGE-WEIGHT-LENGTH SAMPLING

Collection of Smolt by Fyke Net

A 4 ft-by-4 ft fyke net will be fished to obtain samples of smolt for age-weight-length data (Figure 21). The fyke net is generally fished in 3.5 ft of water along specific gravel bars or channels where smolt have been known to pass. Both 10.0 ft wings of the fyke net are anchored with 75 lb to 100 lb anchors. Buoys are attached to the anchor lines when the fyke net is removed from the river for cleaning.

When smolt are abundant, the daily smolt sampling goal is six samples of 100 smolt per day. A sample is comprised of smolt collected each time the cod end of the fyke net is pulled. If more than 100 smolt have been collected in the cod end, a random sample of 100 smolt should be taken and the rest released.

When smolt are not abundant, do not spend an inordinate amount of time fyke netting for smolt which may not be there. On days when the daily sampling goal falls short of 600 smolt, we will combine the samples from subsequent days during post season analysis until we get a full sample of 600 smolt. Therefore it will not be uncommon to fall short of the daily smolt sampling goal during periods of low smolt passage.

Fishing times should be adjusted during the season to coincide with daily peak migration periods. If smolt passage is strong and the sonar counts are steady throughout the day (e.g., Kvichak River smolt), the fyke net sets should be made at periodic intervals throughout the day to sample as many different schools as possible. If the smolt passage becomes restricted to a 1-or-2-hour window daily (e.g., Egegik and Ugashik River smolt), wait a minimum of 5 minutes between fyke net sets to reduce the chances of sampling the same school.

In most cases, Naknek, Egegik, and Ugashik River smolt projects should spend less than two hours total on any calendar day fyke netting. If you have to fyke net more than two hours per day to obtain samples, contact your project leader for advise.

Because of the nature of the smolt outmigration and sampling logistics, Kvichak River smolt will spend more than two hours per day fyke netting. The Kvichak crew should direct their fyke netting effort toward taking 600 smolt per day with representative samples taken throughout the day.

All smolt crews should try to restrict their maximum daily smolt catch to at-or-near 600 smolt per day if possible. There is no need to catch more smolt than we need to satisfy our sampling goal.

The cod-end of the fyke net should be checked regularly during the fishing period. Smolt to be sampled from each set should be placed in a seperate 5 g bucket of freshwater for later identification and sampling. Freshwater should be added to each bucket as needed during fyke netting, transportation, and sampling to keep smolt alive.

All fyke net sets should be numbered and recorded consecutively by cod end number in the Smolt Fyke Net Sample Log (Appendix C.18). This form provides a summary of samples taken and also can be used to calculate catch per unit effort which can be used to verify fish passage and species composition. This information is particularly important when sonar counting conditions are marginal due to weather or when the system is disabled. It is also important to record fyke net fishing times for sets which do not produce catches and be sure to identify and quantify all other species (e.g., smelt, chinook, coho, etc.) in each catch.

On the Smolt Fyke Net Sample Log, record the <u>set and pull times</u> in military time (0001-2400 hours). The calendar <u>date</u> (mm/dd) on the form will be the same as the initial set time. For example, a fyke net set made at 2345 hours on 5/24 and pulled at 0030 hours on 5/25 would be assigned a date of 5/24 and a <u>smolt day</u> (mm/dd-dd) of 5/24-25. Whereas, a fyke net set made after midnight on 5/24 (e.g. 0001 hours on 5/25) would be a assigned a date of 5/25 and a smolt day of 5/24-25.

<u>Do not leave the wings, body, and throat of the fyke net in the river between samples</u>. Even if the cod end is open, smolt passing through the fyke net will loose scales on the mesh and be injured unnecessarily. If we don't need the smolt for AWL or LF samples, lets let them pass unharmed.

<u>When you are not activley fishing for smolt</u>, <u>remove the fyke net from the water</u>. Lay the fyke net out on a grassy bank to dry. When it is dry, clean all sticks and debri from the mesh. Finally, inspect the clean fyke net and repair any damage before resetting it.

Anesthetizing and Handling Smolt

MS-222 (e.g., tricaine methanesulfonate, an isomer of benzocaine) is effective and safe for the anesthesia of sockeye salmon smolt if used as directed. Sedation and various rates of anesthetization are controlled by concentration. The concentration of MS-222 needed to anesthetize smolt may vary with temperature and the size of the fish. Therefore, it is imperative that preliminary tests of anesthetic solutions be made using small numbers of smolt to determine the desired rate of anesthesia and exposure time for specific lots of fish under prevailing conditions.

Concentration Required for Rapid Anesthesia

The concentrations required for rapid anesthesia of smolt for obtaining scale samples, lengths, and weights is about 10-12 mg of MS-222 per liter of clear, cold river water. At this concentration the estimated induction time is about 2-5 min, the estimated maximum tolerated exposure time is about 4-12 min, and the estimated recovery time in fresh water is about 3-19 minutes. Only anesthetize about one-dozen smolt at the same time, to reduce the length of time smolts remain in the anesthetic and avoid unnecessary mortalities.

IMPORTANT: Since, in many cases, relatively rapid rates of anesthesia can be achieved only by exceeding the lethal concentration of MS-222, it is necessary to return anesthetized smolt to fresh water before they are overexposed. Excessive exposures are avoided by observing the following sensory and motor responses of fish which characterize progressively deeper levels of anesthesia:

Sedation - Decreased reactivity to visual and vibrational stimuli; opercular activity reduced.

Total loss of equilibrium - Fish turns over; locomotion ceases; fish swims or extends fins in response to pressure on caudal fin or peduncle.

Total loss of reflex - No response to pressure on caudal fin or peduncle; opercular rate slow and erratic.

Medullary collapse - Opercular activity ceases.

Laboratory and field investigations have shown that the action of MS-222 is readily reversed when the fish are transferred to fresh water before opercular activity ceases. Additional exposure following medullary collapse may result in mortality. A rough estimate of the safe total exposure time can be made by multiplying the time required for anesthesia by a factor of 2-or-3.

Water

MS-222 is very soluble (1:9) and it dissolves readily in river water. The anesthetic solution should be well oxygenated, and its temperature should be similar to that of the water from which the fish are taken.

Method of General Anesthesia

Where rapid or moderately rapid anesthesia is required, MS-222 may be applied in a bath, (e.g., the fish are immersed in the anesthetic solution). Containers may be glass, plastic, steel, or aluminum. Do not used galvanized or brass containers due to dissolution of zinc from untreated containers of these materials. Size of container should be large enough to prevent overcrowding of the anesthetized fish.

Discard anesthetic solutions when a loss in potency is noted, or when the solution becomes fouled with mucus or excrement. <u>Do not discard MS-222 solutions into water supplies or natural waterways</u>.

Reviving Smolt from Anesthesia

After each smolt is sampled, it should be placed in a bucket of cold, fresh water to recover. Add to and/or change the water in this recovery bucket frequently. Make sure that smolt are fully recovered from the anesthetic before releasing them in the river, or they become easy prey for predators.

Preparation of MS-222 Solutions

Prior to use, MS-222 may be weighed out into amounts which are convenient for the volume of water to be used. To convert mg/liter into g/gal: multiply the number of mg by 0.00378.

e.g. 10 mg/liter = 10 X 0.00378 = 0.038 g/gal
12 mg/liter = 12 X 0.00378 = 0.045 g/gal

As you can see, it shouldn't take much of this stuff to knock a smolt out. Therefore, a 5 g bottle of MS-222 should be more than adequate for a whole month of smolt sampling.

Precautions

1. Since MS-222 is absorbed into the blood of fish, residues of the drug may occur in edible tissue. Although the residues dissipate rapidly after the fish are placed in fresh water, treated fish must be held in fresh water above 10° C (50° F) for a period of 21 days

before they are approved for human consumption. Therefore if you like eating smolt, do not eat any which have been anesthetized.

2. HAZARDOUS INGREDIENTS - Benzoic acid, 3-Amino-, Ethyl Ester, Methanesulfonate (e.g. MS-222)

   Avoid inhaling and prevent contact with skin and eyes. May be harmful by inhalation, ingestion, or skin absorption. May cause irritation.

3. Do not overexpose smolt to lethal levels of MS-222.

4. Do not anesthetize more smolt than can be sampled effectively.

Storage and Shelf Life of MS-222

For best results, store MS-222 at room temperature (25° C). Store ready made solutions of MS-222 in a cool place away from light.

MS-222 is a fine white crystallin powder that forms a clear, colorless, acid solutions in water. The color of MS-222 solutions may change rapidly to yellow or brown when exposed to light. This color change does not significantly effect its activity.

Typically, MS-222 has a shelf life of 2-to-3 years. To insure an adequate supply of MS-222 for your project, indicate on your equipment inventory form the quantity of MS-222 that you have left at the end of each field season and the expiration date of the current supply.

Sampling Design

Due to the time involved in sampling smolts for A-W-L data, it may not be possible to process more than about 100 smolts each day for age, weight and length. Therefore, to obtain a 600 smolt daily sample, 500 smolts should be measured only for length after the 100 smolt A-W-L sample has been processed. By calculating the relation between length and age, and length and weight from the A-W-L samples, it will be possible to assign ages and weights to smolts only measured for length. To estimate the proportion of age-1. or -2. smolt in the population within 0.05 of the true proportion with a type I error of 0.05, it is necessary to age 600 smolts during a sample period. Although, it would be desirable to obtain 600 smolt samples each day, due to the time involved in capturing and sampling this number of smolts, it may take 2-to-6 days to obtain a total sample of this size.

If your fyke net catch falls short of a full 600 smolt sample, sample the first 100 smolt for A-W-L data and the rest for length frequency (LF) data only, if possible.

Lengths and Weights

Lengths are recorded to the nearest millimeter from the tip-of-the-snout to fork-of-the-tail. Weights are recorded to the nearest 0.1 gram. Length and weight data for smolts from which scale samples were taken are recorded on the Smolt Age-Weight-Length Form (Appendix C.19). Length frequency data for smolts which were only measured are recorded on the Smolt Length Frequency Form (Appendix C.20).

At times smolt mortality is very high, even prior to sampling. A dead smolt will absorb water and gain weight. Therefore, do not use smolt that have been dead for over 2 hours for A-W-L samples. However these smolt can be used for LF samples. To avoid having to use dead smolt for A-W-L samples, it may be necessary to work up the A-W-L samples before the LF samples.

Scale Samples

Salmon smolt scale samples are actually a smear or cluster of scales that are collected from each smolt. Scale samples are mounted on glass microscope slides with 10 samples per slide. Each slide must be labeled with the location, year, smolt day (mm/dd-dd), cod end number, and the scale series (e.g., 1-10, 11-20, 21-30, 31-40, or 41-50) written clearly on the frosted end of the slide with ultra-fine point permanent magic marker as shown below:

Egegik R.	1	2	3	4	5
1994					
5/28-29					
Cod End #029					
Samples 1-10	6	7	8	9	10

Gently scrape 5-to-10 scales from the left side of each smolt (from the area between the lateral line and dorsal fin) with a scalpel or knife blade and smear them on the proper area of the slide. The area where you mount the scales on the slide must correspond with the sample # on the Smolt Age-Weight-Length Form where you record the length and weight of the smolt being sampled. When mounting the smears, the scales in each cluster should be teased apart with a dissecting needle. This will ensure that scales do not overlap and will enable them to be aged.

Keep your equipment (e.g., scalpel, dissecting needle, balance scale, paper towel blotter) clean between samples to avoid having stray scales mixed with subsequent samples. Keep each of the 10 scale groups on the microscope slide in separate and distinct clusters. Take the time to separate scale clusters because overlapping scales can not be aged. Also be careful to mount the scales so that the external surface (e.g., as they are before you remove them from the smolt) remains up on the microscope slide. There are two sides to every scale, the top-side has rings or annuli on them which can be used for aging and the bottom-side is smooth and can not be aged. Therefore do not to turn the scales over when you mount them, because inverted scales can not be aged.

After mounting 10 clusters of scales per slide, a plain glass slide (without a frosted end) should be placed over the slide with the mounted scales. Transparent tape should be used to hold the two slides together. Do not place tape over portions of the slides with scale smears. Place tape at the frosted end of the slides.

Up to five slides (50 smolt) can be used for each Smolt Age-Weight-Length Form (Appendix C.19). Please record time of capture.

Completed scale slides should be placed in a microscope slide box and arranged consecutively by cod end number. Samples from different cod end numbers can be separated in the microscope slide box by alternating arranging slides with the same cod end number with the labels on the right or left side of the box. When the microscope box is full of completed scale slides, be sure to label the outside of the box with your projects name, the year, the first cod end number, and the last cod end number in this set of scale samples.

Age Composition

How to Differentiate Age-1. and Age-2. Smolt by Length

For the purposed of inseason analysis, the appropriate length for differentiating age-1. from age-2. smolt can be calculated using the historical mean length for each age group for your particular river. This historical length data is updated annually in a regional information report entitled "Bristol Bay Sockeye Salmon Smolt Studies for 19??" and this information is summarized for each river in tables entitled "Age composition of total migration and mean fork length and weight by age class for sockeye salmon smolt, _____ River, 19??-19??."

Use the historical mean lengths by age class to calculate the length (L) for differentiating age-1. and -2. smolt as follows:

$$L = \left(\frac{a-b}{2}\right) + b$$

where a = historical mean length for age-2. smolt and
b = historical mean length for age-1. smolt.

After length (L) has been calculated for the current year, smolt can be classified by age as follows:

$$Age\text{-}1.\ Smolt \leq Length\ (L) < Age\text{-}2.\ Smolt$$

To calculate daily percent age compositions, sum all age-1. and -2. smolt on all LF and AWL samples together for that smolt day.

WEATHER OBSERVATION RECORDS

Daily weather conditions are recorded on the Climatological and Stream Observation Form, (Appendix C.21). All camps are equipped with hand-held thermometers for measuring water temperature and maximum-minimum thermometers for measuring air temperature. Since the type of thermometers available at each field camp may vary, please identify the appropriate units (e.g., °F or °C) for your temperature measurements on your Climatological and Stream Observation Forms. Cloud cover and water clarity are rated subjectively. Wind speed (mph) and direction are measured with a hand-held wind meter and compass. Precipitation is measured to the nearest 0.01 in or 0.5 mm with a rain gauge, if available, or rated subjectively. See Appendix F. for a listing of weather equipment.

RADIO SCHEDULES

Each smolt camp will maintain daily radio schedules with the King Salmon ADF&G office on SSB radio frequency 4560 at 0830 hours and 1600 hours. The radio call sign for the King Salmon ADF&G office on this frequency is KWB 344 King Salmon. The radio call sign for all ADF&G field camps in Bristol Bay on this frequency is WNJI 929 followed by the name of your project (e.g., WNJI 929 Kvichak Smolt).

Daily smolt information will be summarized and reported on the Sockeye Salmon Smolt Project Radio Log (Appendix C.22).

The 0830 hour radio report consists largely of 0800 hour water temperature and comments about what has been happening at your site since the last radio check. Some items which are typically discussed at this time are as follows:

(1) What is the weather doing? Any ice problems in the river last night? The answers to these types of questions are particularly pertinent if you are expecting a supply plane to arrive that day.

(2) How did the fyke net do last night? Did you get a full sample? How many fish were sampled?

(3) Based on the sonar counts and the fyke net catches, how would you characterize the smolt outmigration for the previous night? What were the hours of peak smolt passage and which array(s) had the highest count.

(4) Discuss any equipment problems.

(5) If you are getting low on food, fuel, or supplies you can transmit a list of items needed on the next supply plane. You should try to get input from all members of your crew when putting this list together and it is highly recommended that you transmit it to King Salmon a day-or-two in advance of when you expect the supply plane. This gives the supply personnel in King Salmon time to assemble the items needed and it also enables him/her to call you back to verify specifics of your requests if they have any questions. If he/she knows exactly what you want, he/she has enough time to assemble it, and the pilot can fit it into the plane then you should get all of the items that you need.

At the 1600 hour radio schedule you should transmit your daily and cumulative sonar counts and the sample size and percent composition of age-1. and -2. smolts of the AWL sample that was probably collected the previous night. Any other comments or needs can also be relayed at this time.

Traditionally the radio reception at the King Salmon ADF&G office is best in the morning. Therefore if you have something important to say, you usually have a better chance to say it in the morning. Occasionally there may also be problems with static on the radio in the morning. Should this happen try calling back after 1100 hours, it typically will clear up by that time. During the afternoon and evening hours there tends to be more static and interference on the SSB radio.

The King Salmon ADF&G office stands by on SSB radio frequency 4560 during the smolt season. Therefore anytime there is someone in the office within hearing distance of the radio you can contact the office on your SSB. You don't have to wait until an established radio schedule to call, particularly if you have an emergency, a problem, or important information to relate.

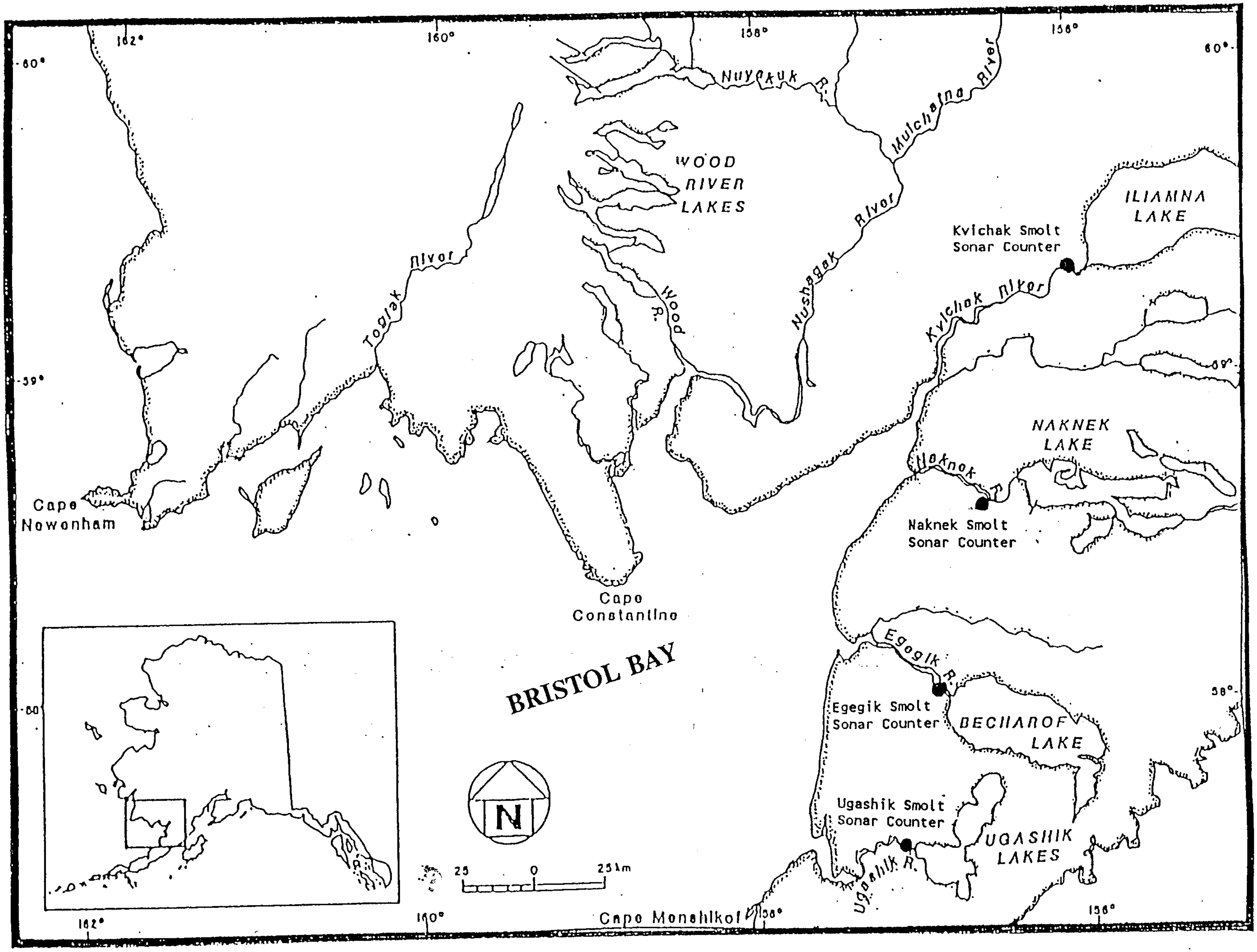


Figure 1. Bristol Bay Management Area with major rivers and locations of current smolt sonar counting projects.

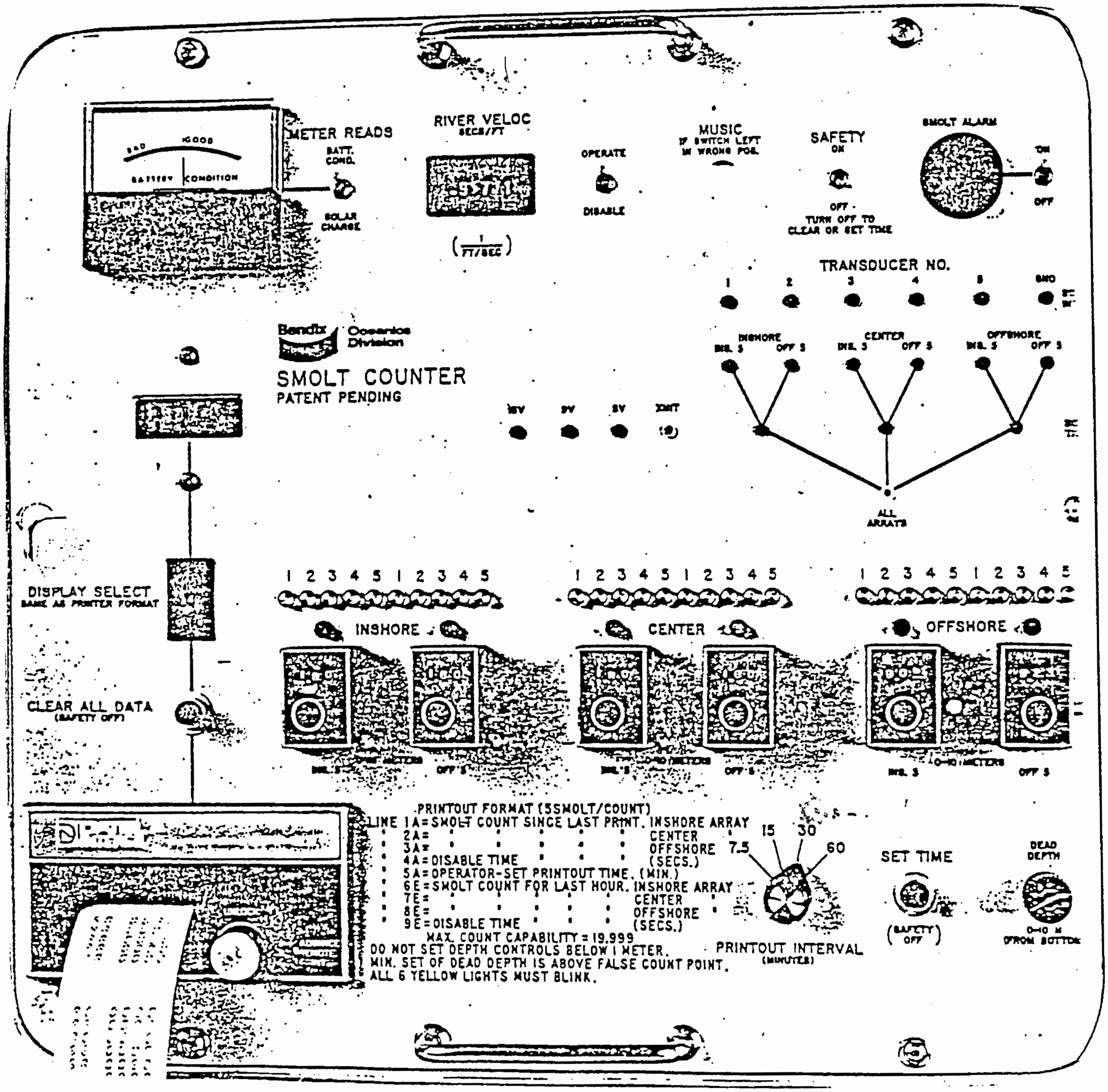


Figure 2. Bendix, Model 1982 and Model 1983 smolt sonar control unit.

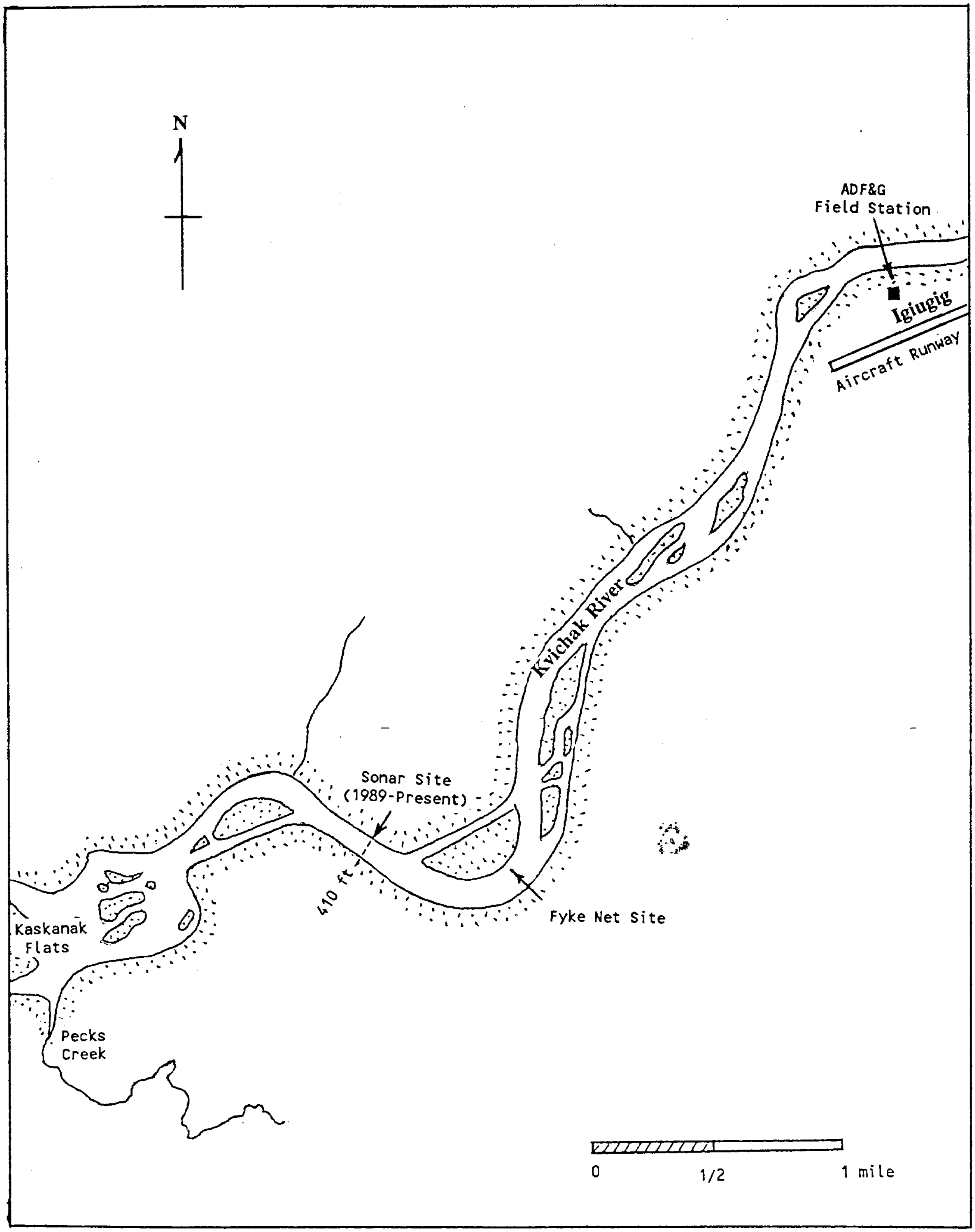


Figure 3. Kvichak River smolt sonar and fyke net sites.

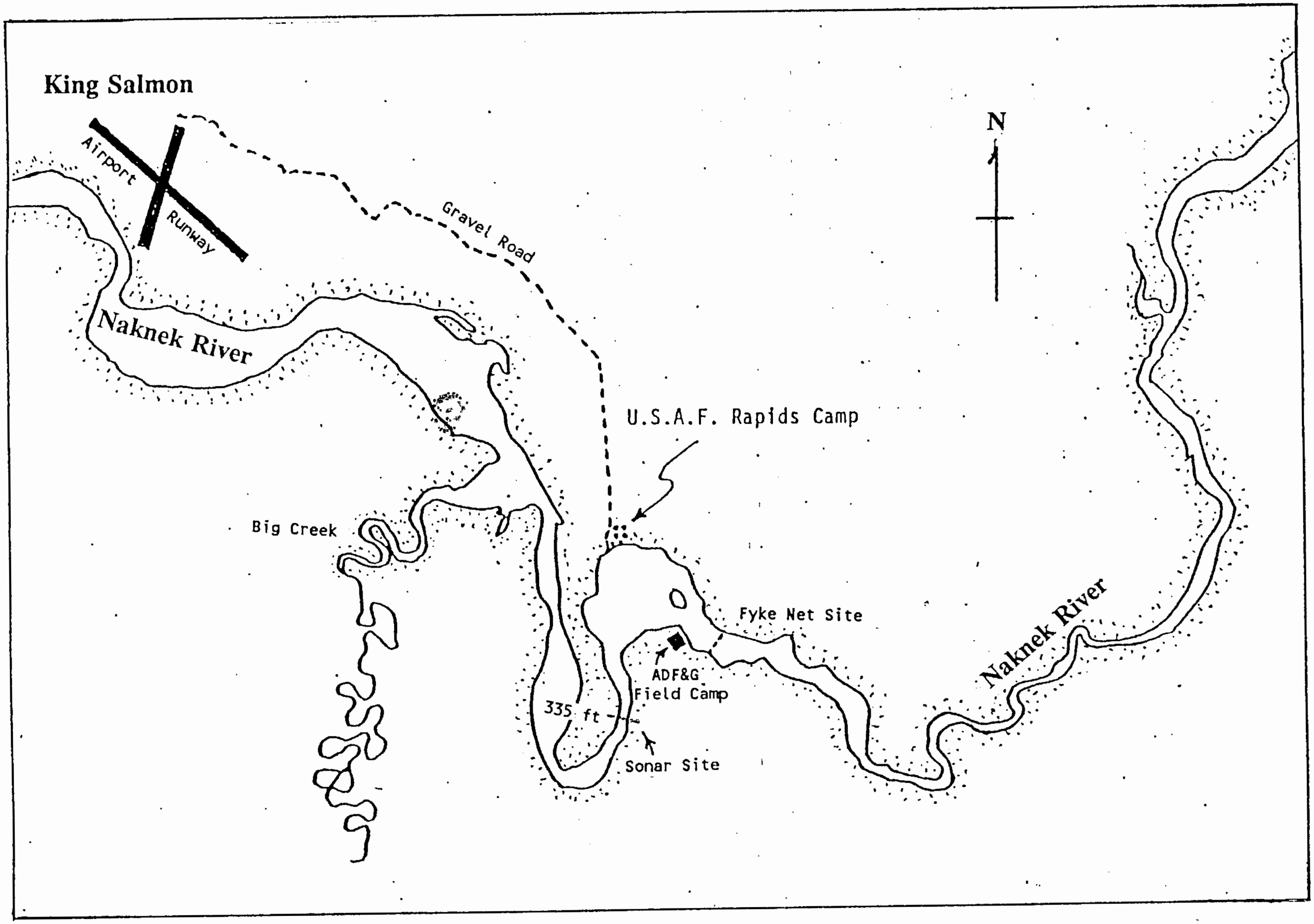


Figure 4. Naknek River smolt sonar and fyke net sites.

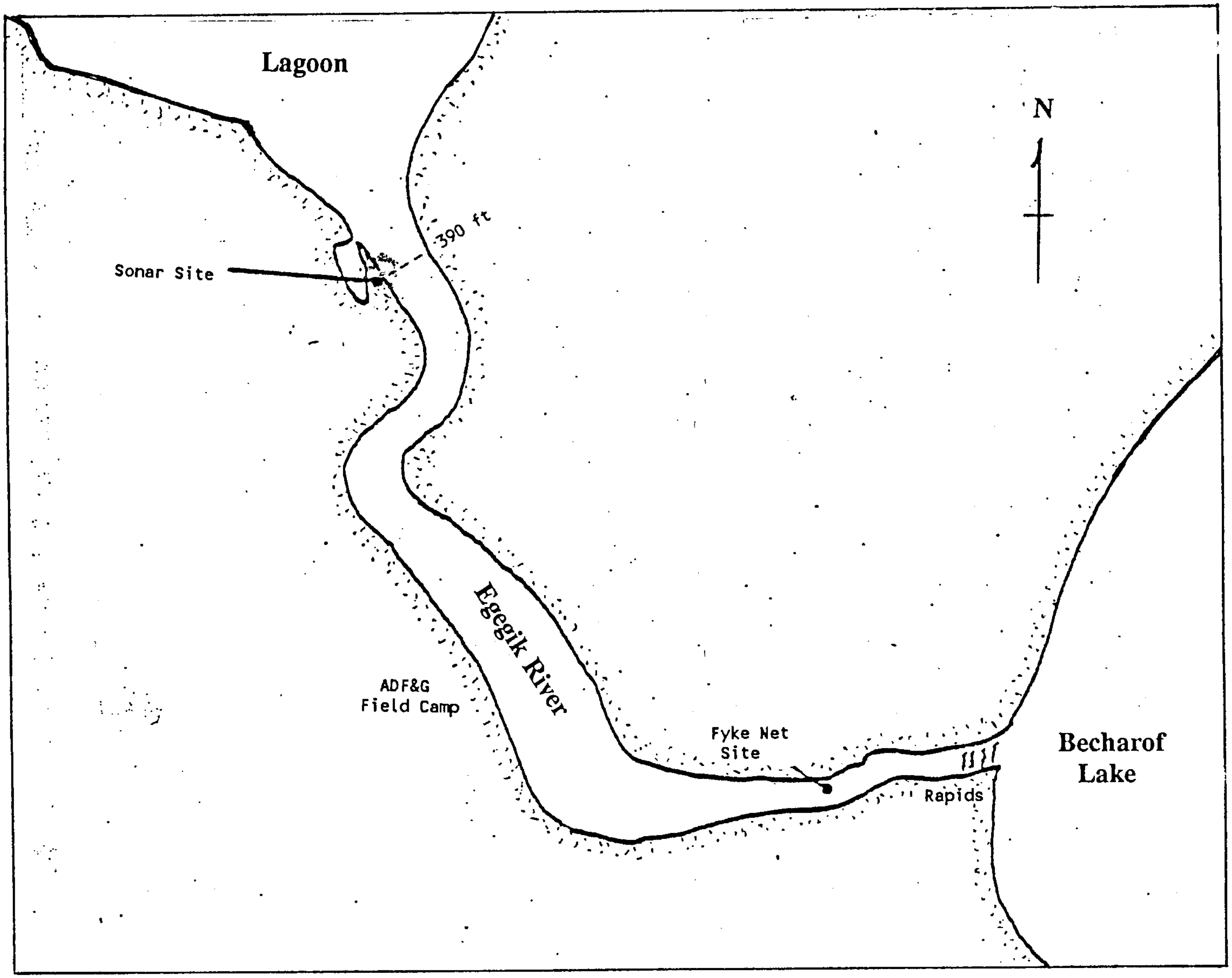


Figure 5. Egegik River smolt sonar and fyke net sites.

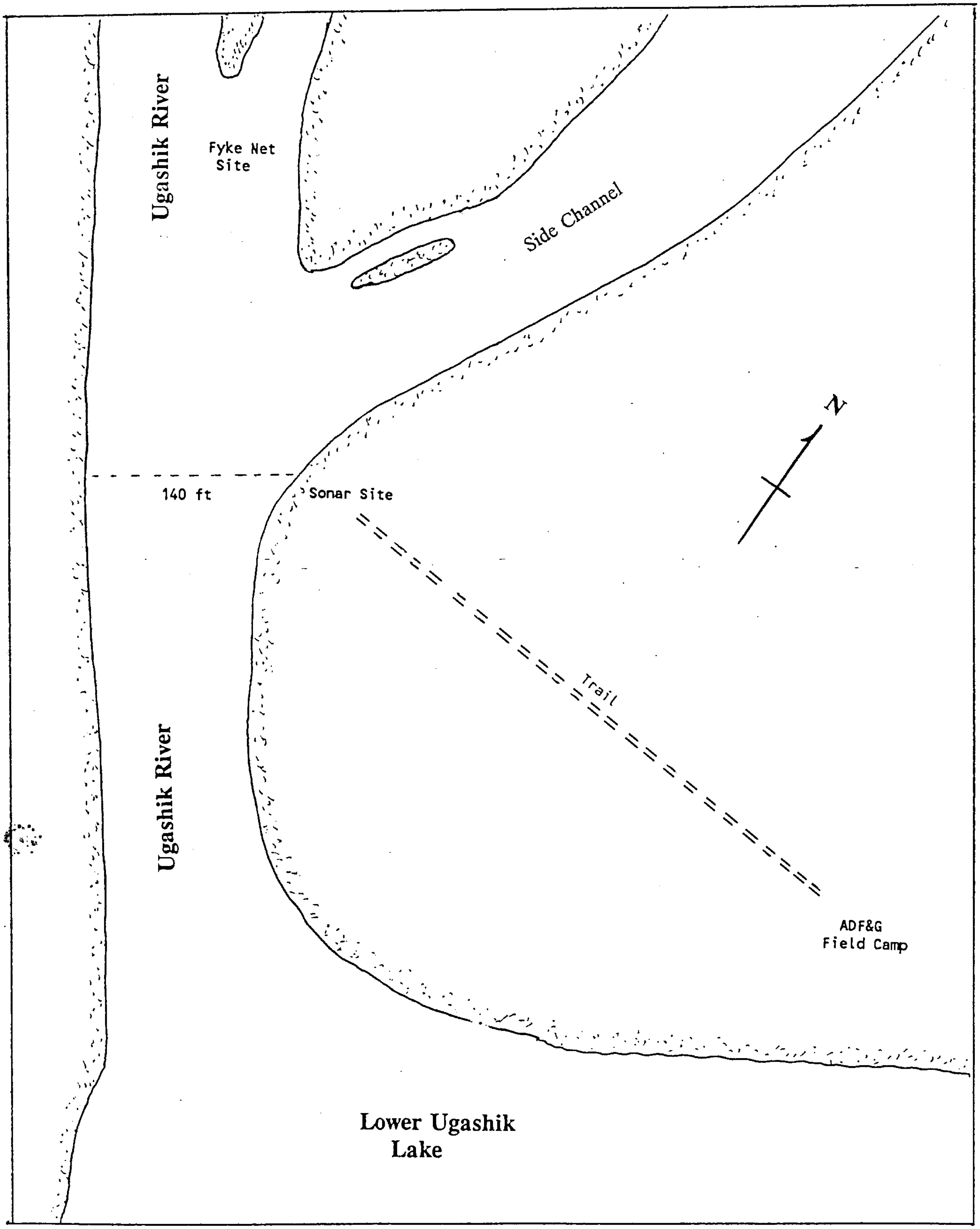


Figure 6. Ugashik River smolt sonar and fyke net sites.

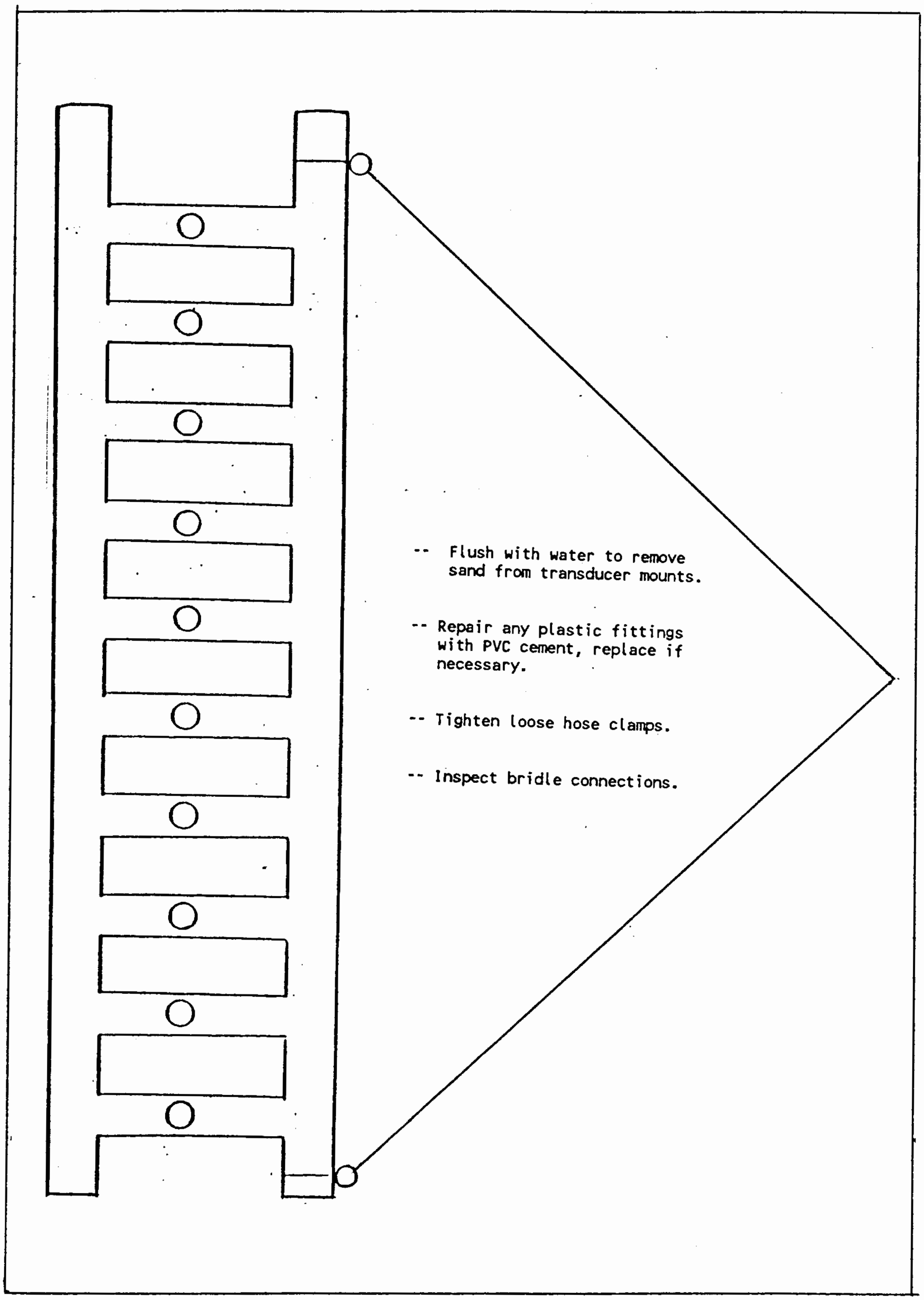


Figure 7. Examining the array before the transducers are mounted.

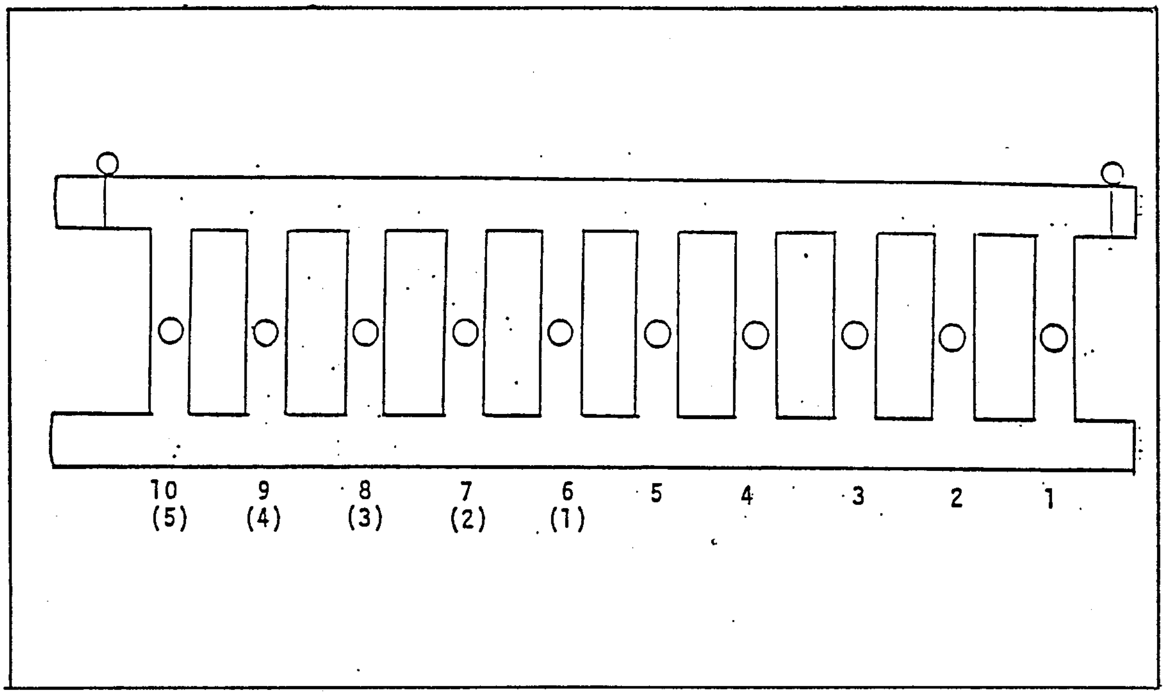


Figure 8. Transducer positioning.

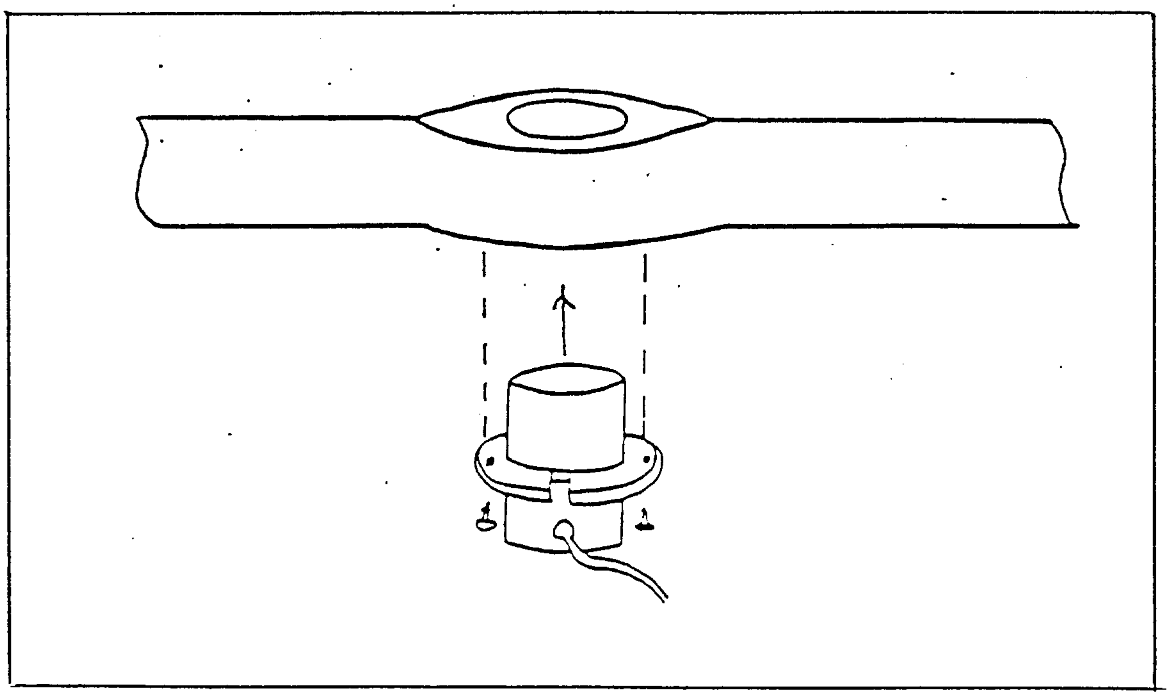


Figure 9. Transducer mounting.

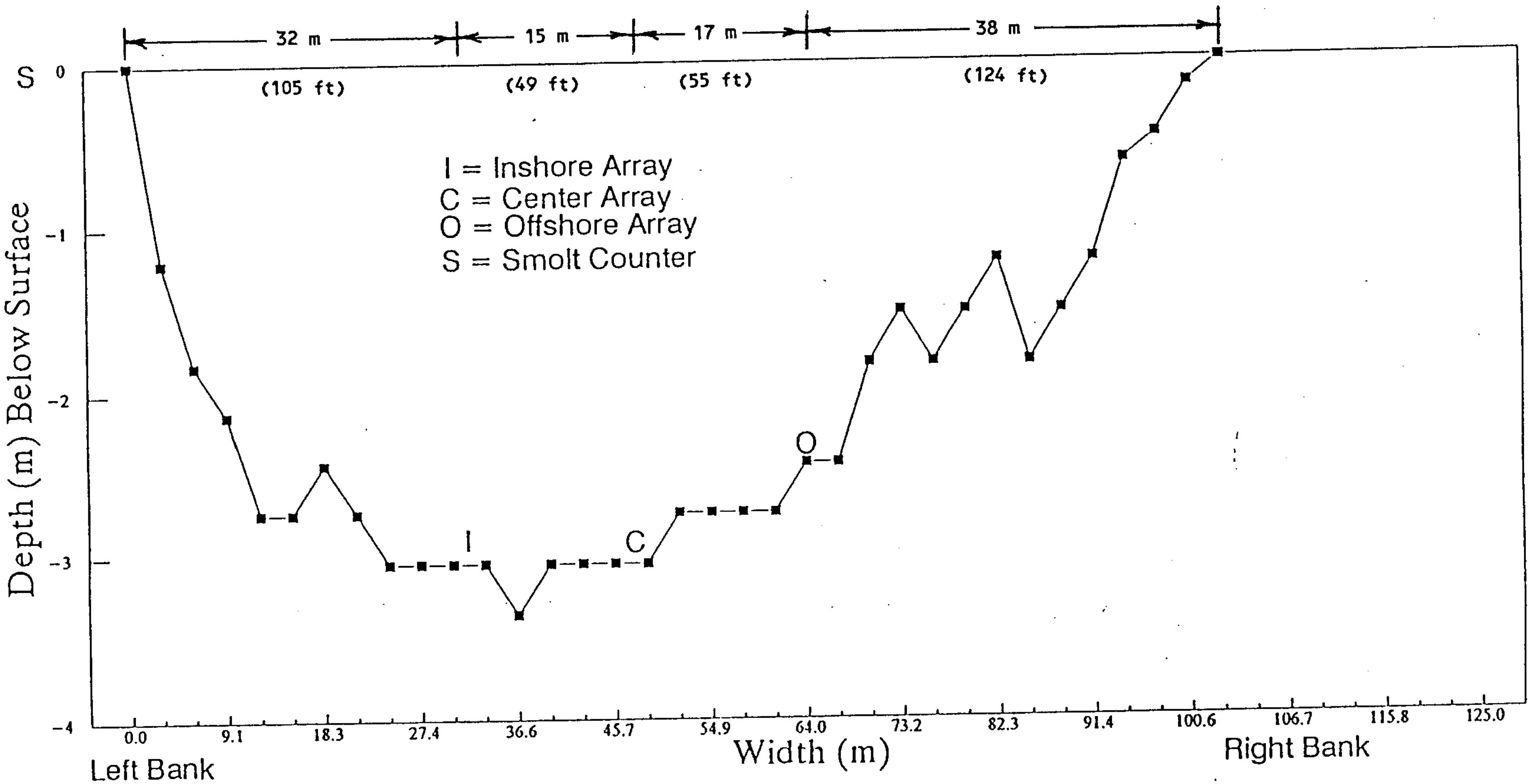


Figure 11. River bottom profile and sonar array placement in the Naknek River.

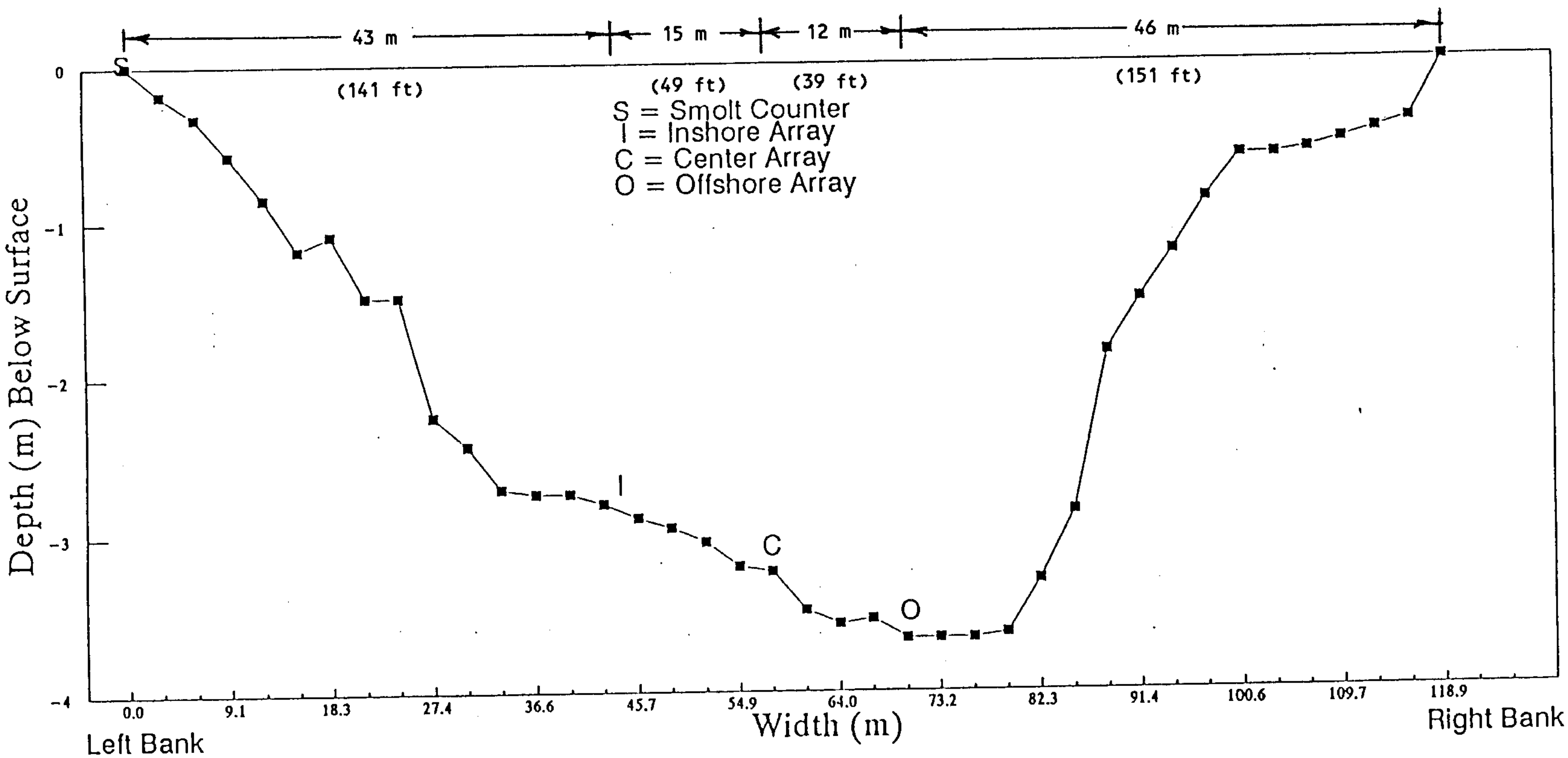


Figure 12. River bottom profile and sonar array placement in the Egegik River.

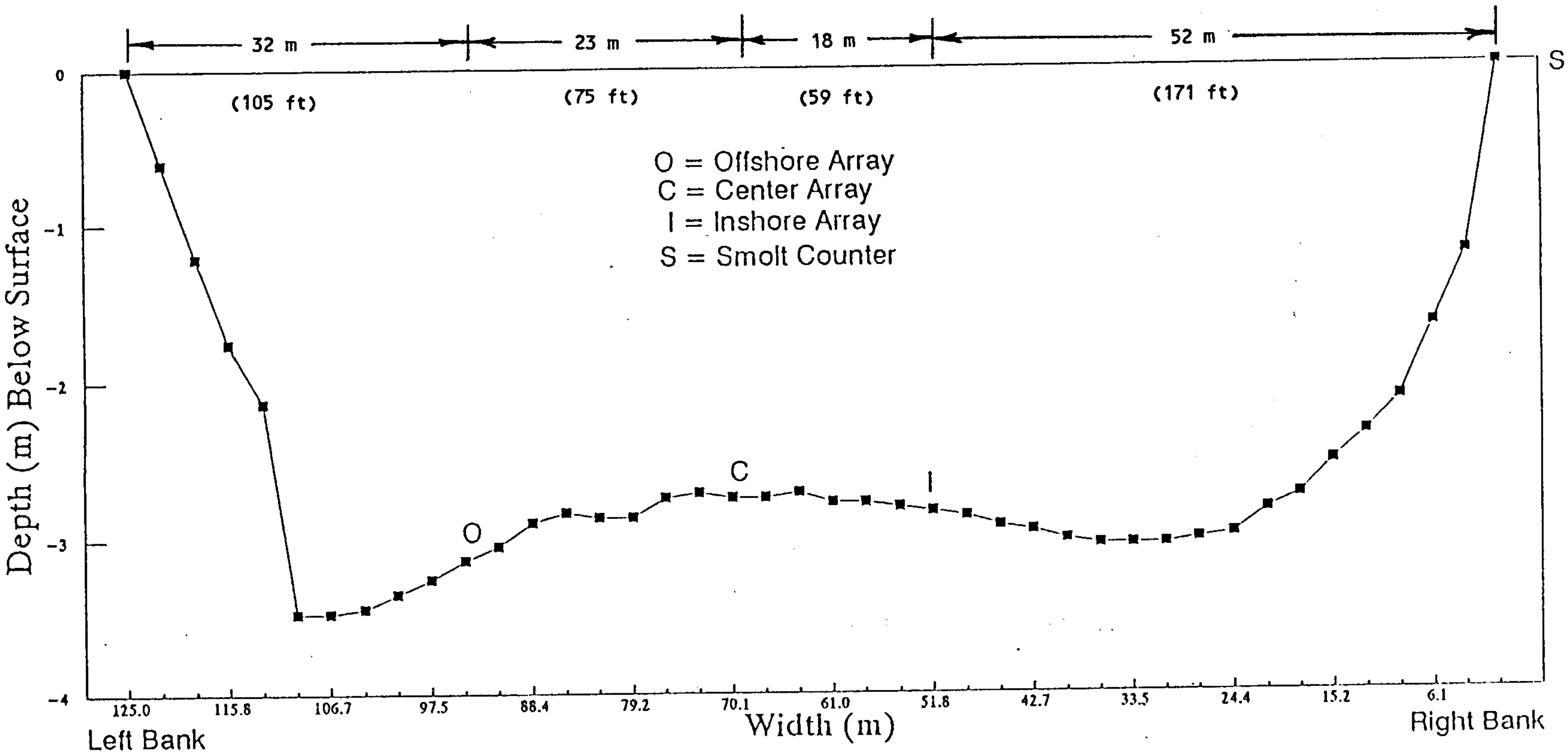


Figure 10. River bottom profile and sonar array placement in the Kvichak River.

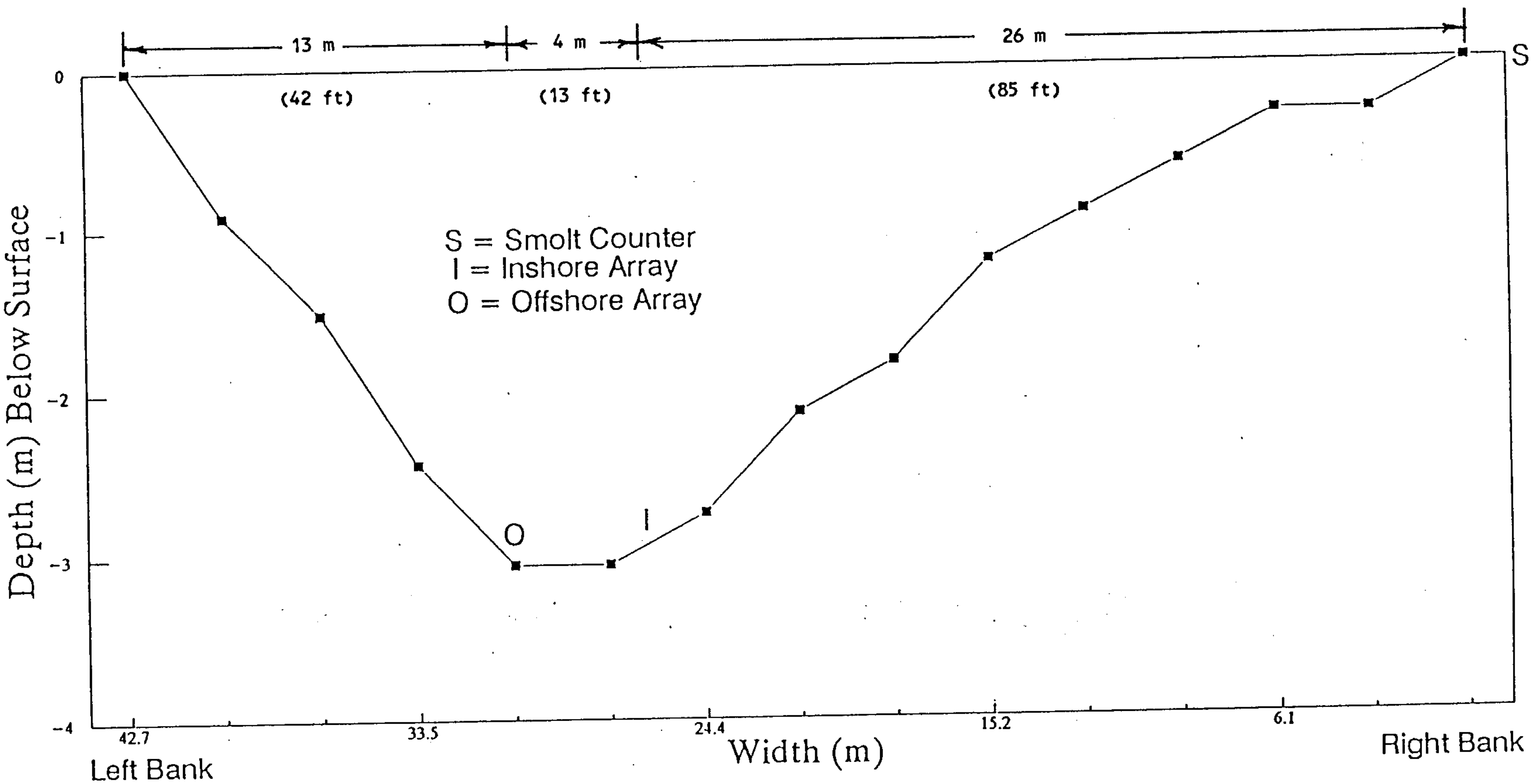


Figure 13. River bottom profile and sonar array placement in the Ugashik River.

INSTALLATION:

1. Plug round connector on power supply cords (e.g., pair of red and black wires with battery clips or lugs on the ends) into 12-volt battery jack on right side of SMOLT COUNTER.
2. Connect BLACK wire #1 from 12-volt battery jack on SMOLT COUNTER to BATTERY (-).
3. Connect RED wire #1 from 12-volt battery jack on SMOLT COUNTER to BATTERY (+).
4. Plug double-pronged banana plug into solar panel jack on right side of SMOLT COUNTER.
5. Connect BLACK wire #2 from solar panel jack on SMOLT COUNTER to left terminal screw on upper side of VOLTAGE REGULATOR.
6. Connect RED wire #2 from solar panel jack on SMOLT COUNTER to right terminal screw on lower side of VOLTAGE REGULATOR.
7. Connect BLACK wire #3 from left terminal screw on upper side of VOLTAGE REGULATOR to upper terminal on left side of VOLTAGE REGULATOR.
8. Connect RED wire #3 from right terminal screw on lower side of VOLTAGE REGULATOR to lower terminal on left side of VOLTAGE REGULATOR.
9. Connect BLACK wire #4 from upper terminal on left side of VOLTAGE REGULATOR to SOLAR PANEL (-).
10. Connect RED wire #4 from lower terminal on left side of VOLTAGE REGULATOR to SOLAR PANEL (+).

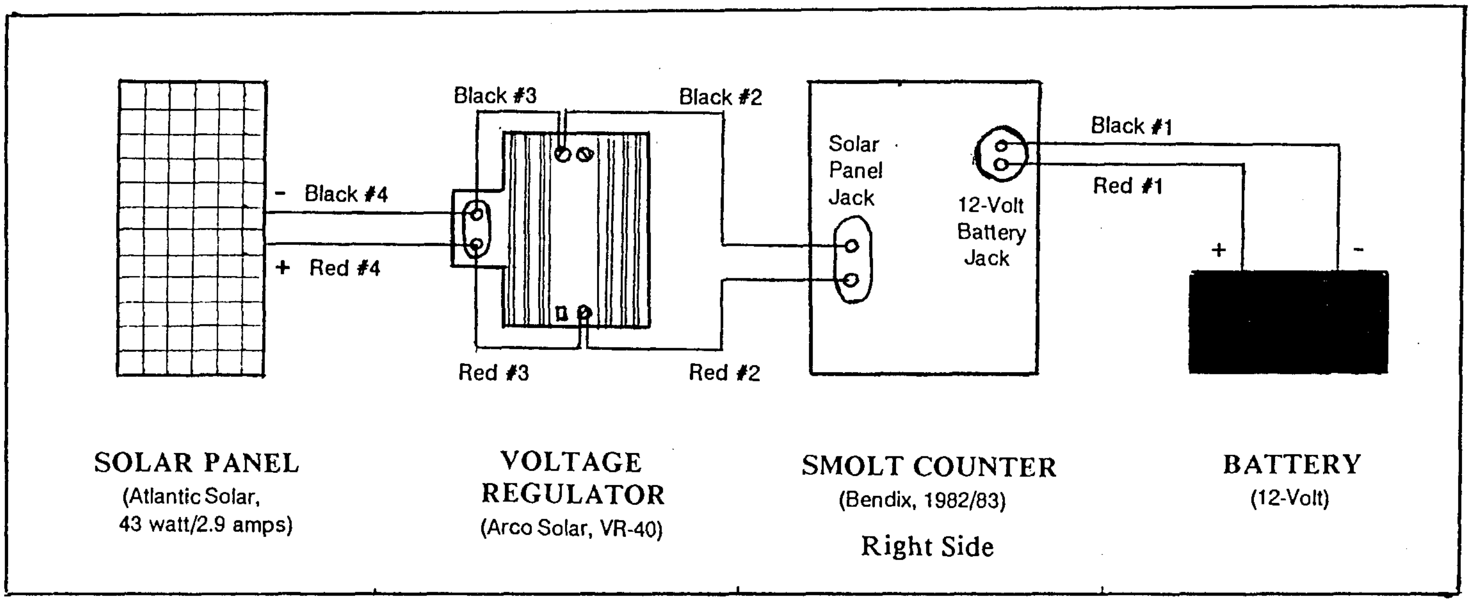
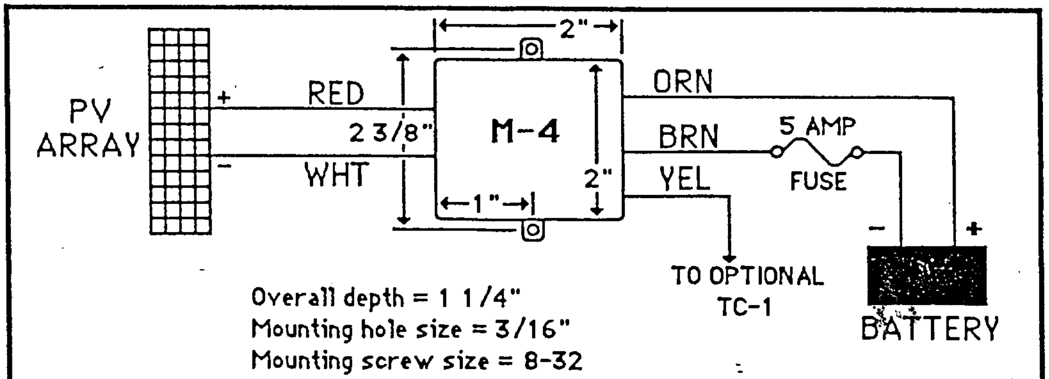


Figure 14. How to wire the power supply for the smolt sonar counter.

INSTALLATION:

1. Mount the unit, using the two mounting tabs. The unit is fully weather proof and may be mounted anywhere.
2. Connect the RED wire to PV(+).
3. Connect the WHITE wire to PV(-).
4. IF the TC-1 (temperature compensation) option has been installed, connect it as instructed in the TC-1 instruction sheet now.
5. Connect the ORANGE wire to BATTERY(+).
6. Connect the BROWN wire WITH AN IN LINE 5 AMP FUSE to BATTERY(-).

Test the unit operation by connecting a voltmeter across PV(+) and PV(-). When in the charging mode, the PV voltage will be 0.5 V higher than the battery voltage. When the battery is fully charged, you may observe PV voltage pulsing from 14 VDC to the PV VOC (about 19 VDC or so).



RED→ PV+, WHITE→ PV-, ORANGE→ BAT+, BROWN→ BAT-, YELLOW→TC-1

Figure 15. How to wire a voltage regulator for a solar panel.

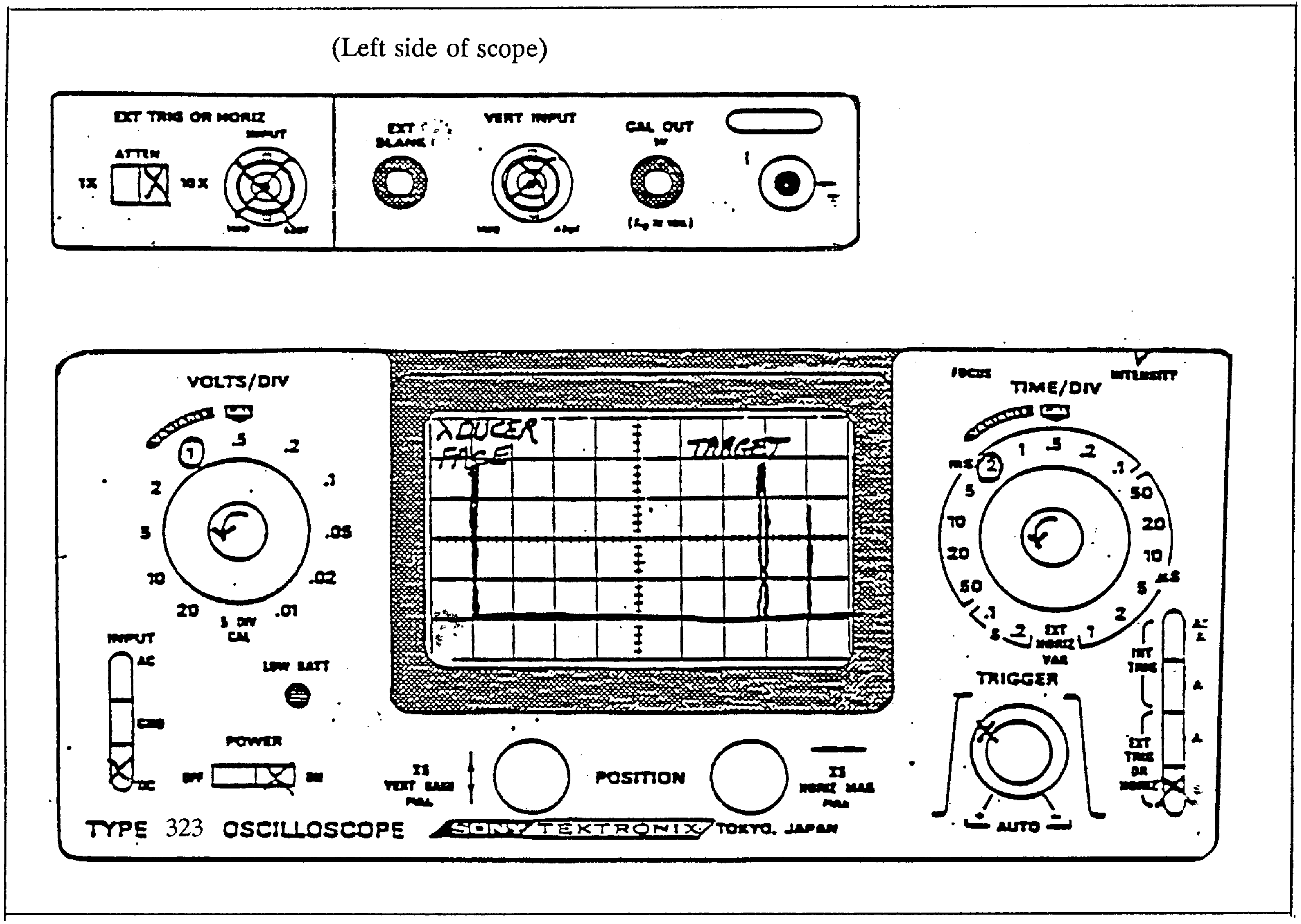


Figure 16. Front and left side view of a dual trace Tektronix, Model 323, 4 MHZ oscilloscope.

INSTALLATION:

1. Plug power supply cord (e.g., pair of red and black wires with battery clips or lugs on the ends) into external DC input port on back side of OSCILLOSCOPE.
2. Connect BLACK wire #1 from external DC input port on back side of OSCILLOSCOPE to BATTERY (-).
3. Connect RED wire #1 from external DC input port on back side of OSCILLOSCOPE to BATTERY (+).
4. Plug external trigger cord into external trigger (EXT TRIG) jack on back side of OSCILLOSCOPE.
5. BLACK wire #2 from external trigger jack on OSCILLOSCOPE is not used and is left unconnected.
6. Connect RED wire #2 from from external trigger jack on OSCILLOSCOPE to jack for whichever array on SMOLT COUNTER you wish to test (e.g., all arrays, inshore, center, offshore, inshore-in or -off, center-in or -off, offshore-in or -off).
7. Plug input cord into input jack on back side of OSCILLOSCOPE.
8. Connect BLACK wire #3 from input jack on OSCILLOSCOPE to ground (GND) jack on upper right side of SMOLT COUNTER.
9. Connect RED wire #3 from input jack on OSCILLOSCOPE to whichever transducer number (e.g., 1-5) you wish to evaluate on the upper right side of SMOLT COUNTER.

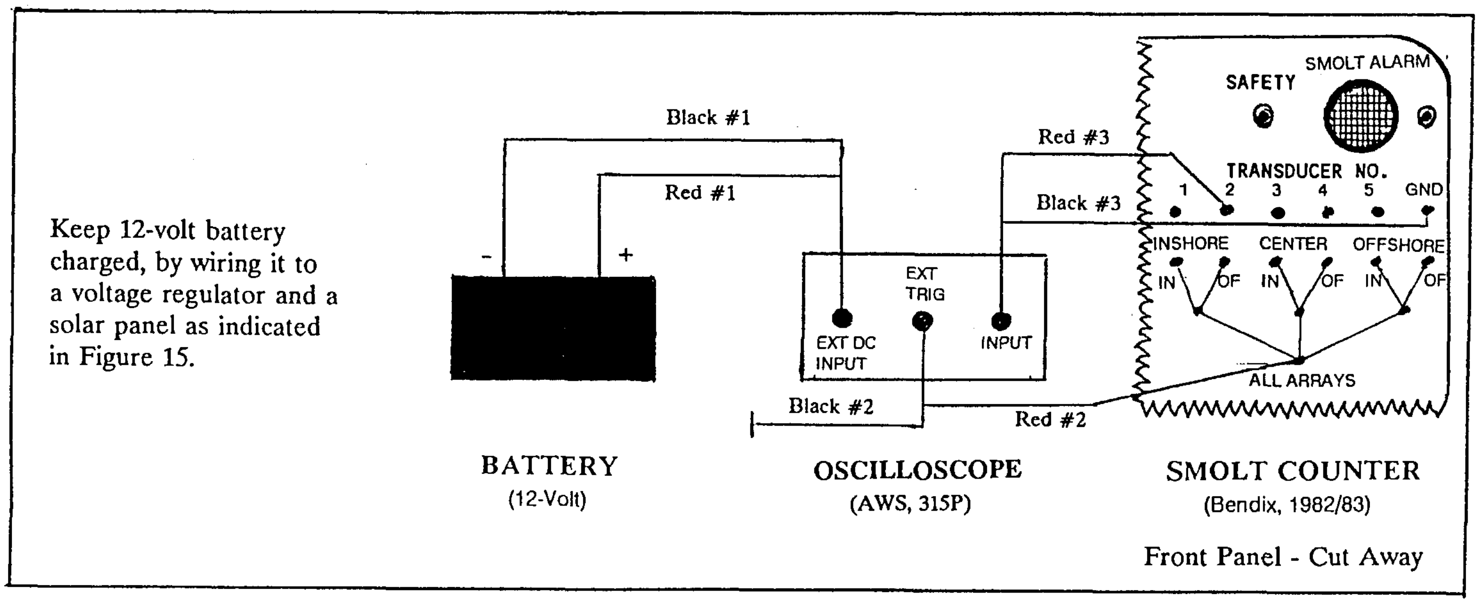


Figure 17. How to wire an oscilloscope to a 12-volt battery and the smolt counter.

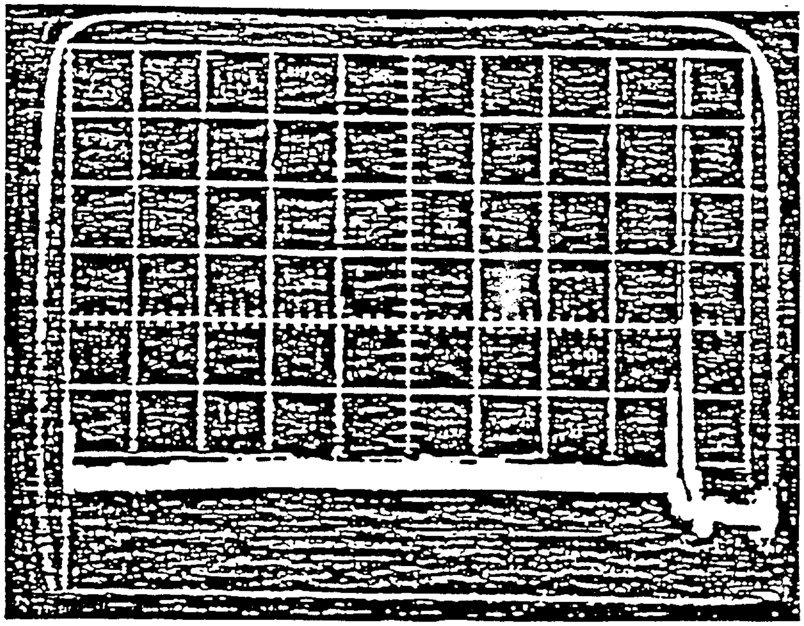


Figure 18. Oscilloscope pattern of properly functioning transducers in clear water with no smolt passing.

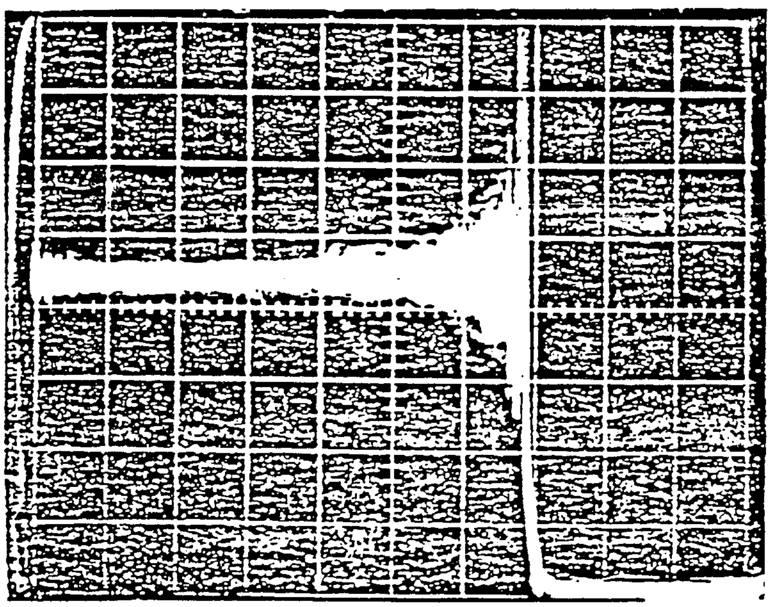


Figure 19. Oscilloscope pattern of properly functioning transducers in clear water passing in the middle of the water column.

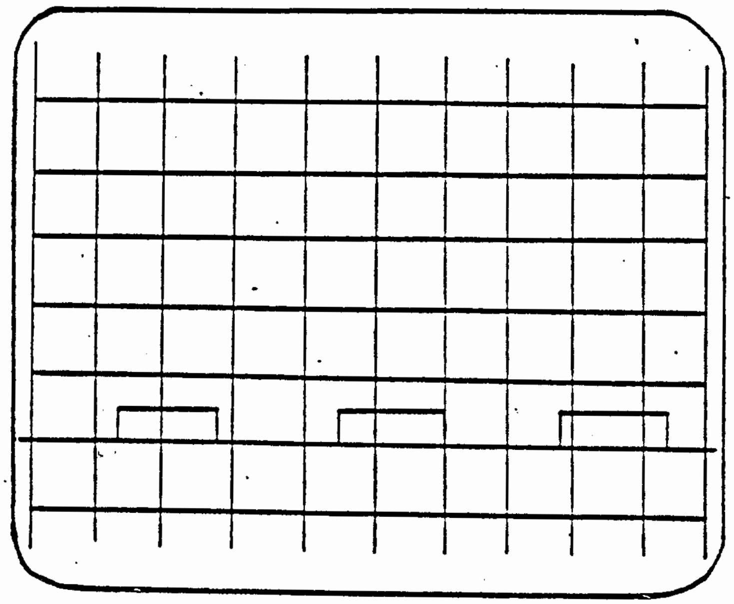


Figure 20. Square wave generated on the oscilloscope to test proper operation of probe.

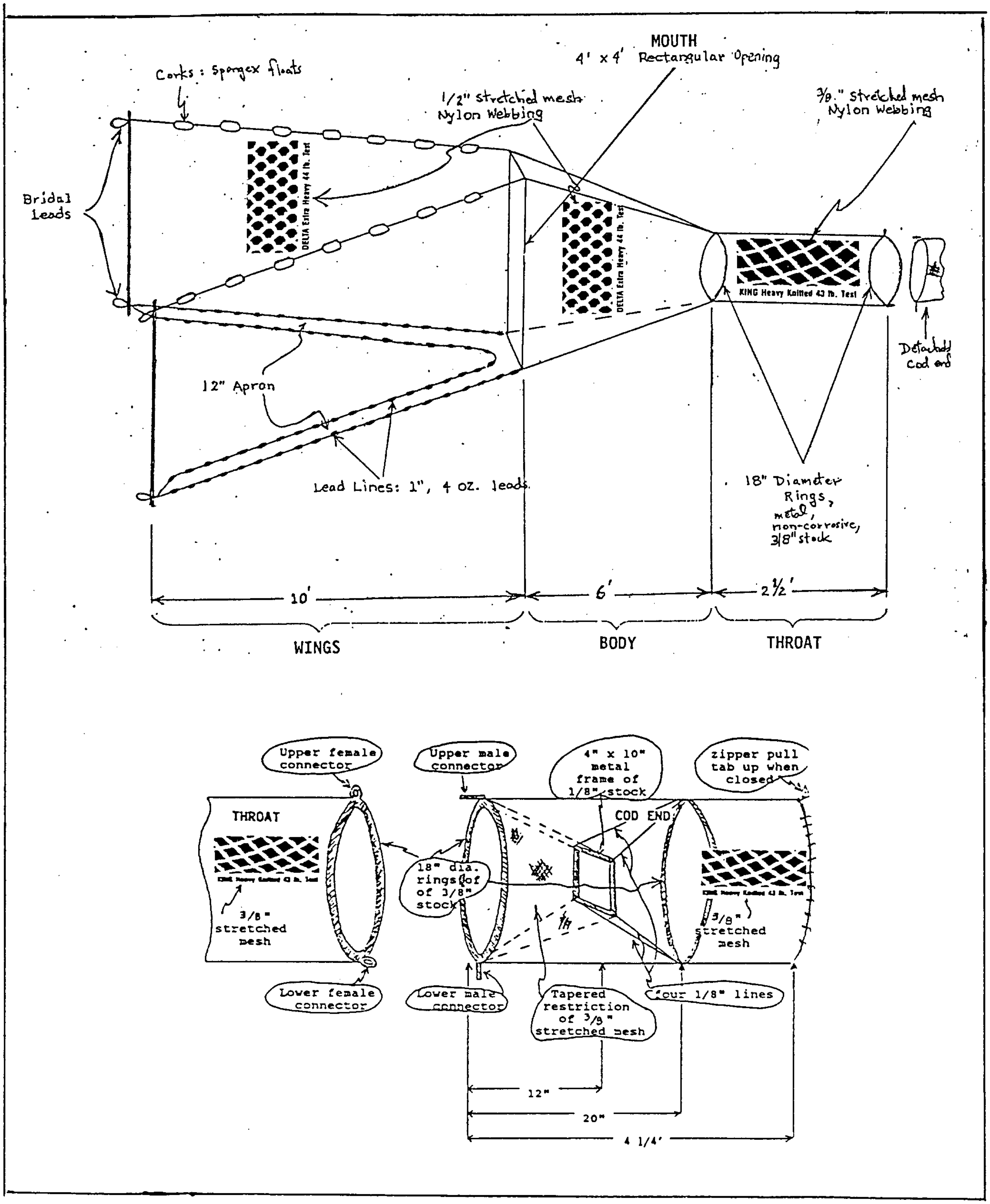


Figure 21. Diagram and specifications of a 4 ft by 4 ft fyke net used to capture sockeye salmon smolt in Bristol Bay tributaries.

APPENDIX A.

Supplies from Anchorage

Project Leader Will Purchase and/or Bring These Items for Each Project

1 line, manila (500') - 3/8" diameter (enough to retie one 300' cable bundle every 3 yrs)

10 tape, electrical (rolls)

2 binders, 3-ring notebook - containing operation manuals, blank data forms, inventory, etc.

2 tape, scotch (roll)

2 paper clips (boxes) - regular and large, 1 each

2 binder clips - small and medium, 1 each

APPENDIX B.

Equipment Stored in King Salmon

1 radio, single side band - Icom, Model M700 with 3230/4560 frequency antenna

5 batteries, 12-volt

1 microscope, dissecting

1 counter, smolt sonar - Bendix, Model 1982 or 1983 w/battery connector cables

3 boxes, sonar array cables and transducers (ITC, Model 5095) - 10 sets of cables and transducers per box (Ugashik - 2 boxes)

3 solar panels - Atlantic Solar, 43 watt, 2.9 amp each with a voltage regulator (model M-4-12V)

3 motors, outboard - 25-35 hp, long shaft

4 transducers, sonar (spares) - ITC Model 5095, 235 Khz, 9° half power beam width with 330'(standard length) RG58 coaxial cable (A/U or C/U, stranded center core, PVC exterior) and soldered BNC connector

3 tool boxes, outboard - with spark plug wrench, spark plugs, pliers, sheer pins, screw driver

1 flow meter - Gurley, Model 625 (flows $\leq$ 3 ft/s) or Model 622 (flows $\geq$ 3 ft/s)

1 oscilloscope - Tektronics, Model 323, 4 MHZ with probes and battery cables

1 printer - Datel, Model DDP-Q7 (spare)

6 rolls printer paper - Datel #32-224570 (10 rolls/box @ 130 ft/roll)

1 generator, 110 volt - for recharging batteries (as needed during cloudy weather)

groceries for 3-4 people for 1 week

APPENDIX B.(Continued)

Equipment Stored in King Salmon

4 tanks, gas (6 gal) - for outboard motor

3 hoses, gas - for outboard motor

1 oil, 2-cycle (5 gal) - for outboard motor (Ugashik - 16 qts)

1 grease, lower unit (?? oz tube) - for outboard motor

1 tank, propane (100 lbs) - with regulator

3 slides, microscope slides (boxes) - frosted

3 slides, microscope slides (boxes) - plain

APPENDIX C.

Smolt Field Data Forms

Alaska Department of Fish and Game

EQUIPMENT INVENTORY

CFM&D Division

Date ____________ Page ____ of ____

Project Name ____________ Preparer's Initials ____

Quantity	Item Description	Manufacturer	Model	Serial Number	Property Number	Condition	Storage Location	Comments

Form No. BB-95-12

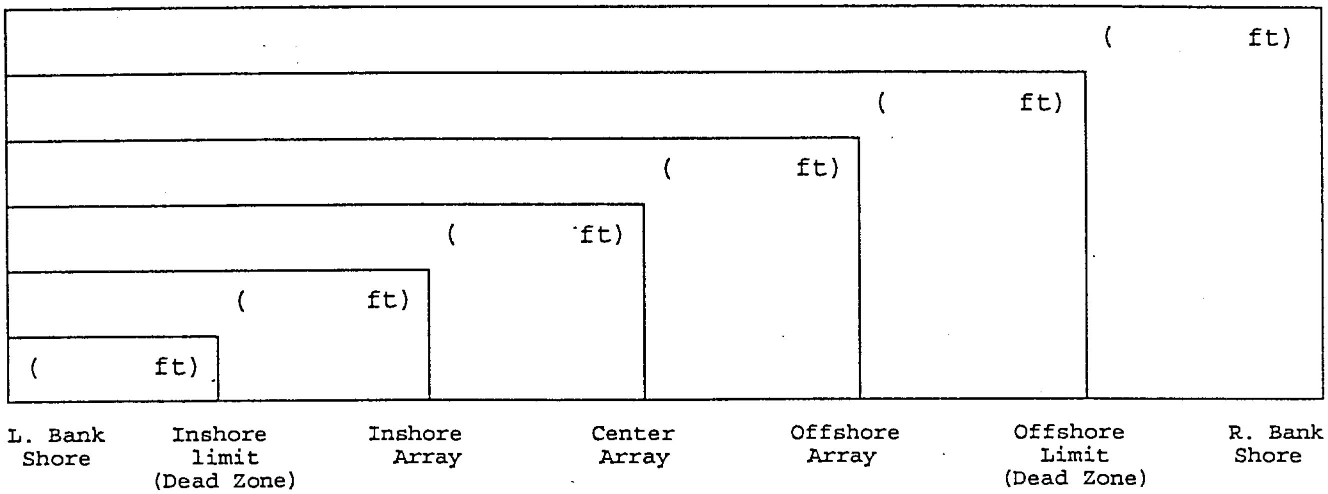
Appendix C.1. Equipment inventory form.

ALASKA DEPARTMENT OF FISH AND GAME
CFM&D DIVISION

Array Distance and Bottom Profile Form (3 Array System)

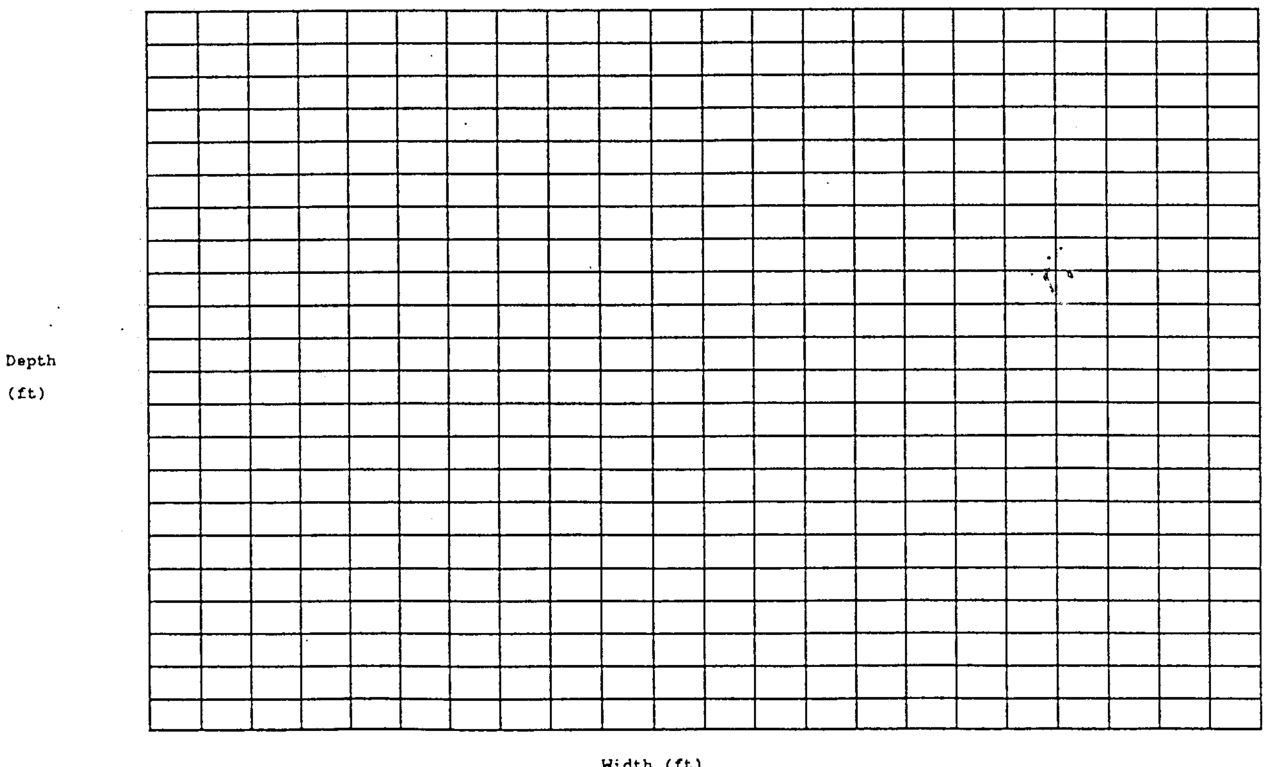
Project Location - Naknek River Smolt   Date - ____________________

ARRAY DISTANCES
(facing downstream)



BOTTOM PROFILE
(facing downstream)

L. Bank   R. Bank



Form No. BB-95-01A

Appendix C.4. Array distance and bottom profile form (Naknek River).

ALASKA DEPARTMENT OF FISH AND GAME
CFM&D DIVISION

Field Camp Gas and Oil Consumption Form

LOCATION ____________________ YEAR ________ CREWLEADER ________

AMOUNT ON HAND AT START: White Gas ___________ Red Gas___________

Aviation Gas (80/87) ___________ Stove Oil ___________ Motor Oil __________

Outboard Motor Oil ________________ Outboard Gear Grease _______________

Propane ________________________ Other (Specify) _______________________

AMOUNT RECEIVED DURING THE FIELD SEASON:

Date	White Gas (gal)	Red Gas (gal)	80/87 (gal)	Stove Oil (gal)	Motor Oil (qts)	Propane (lbs)	Outboard Oil (qts)	Grease (amt)

AMOUNT ON HAND AT THE END OF THE FIELD SEASON:

Total							
Storage Local							

Form No. BB-95-11

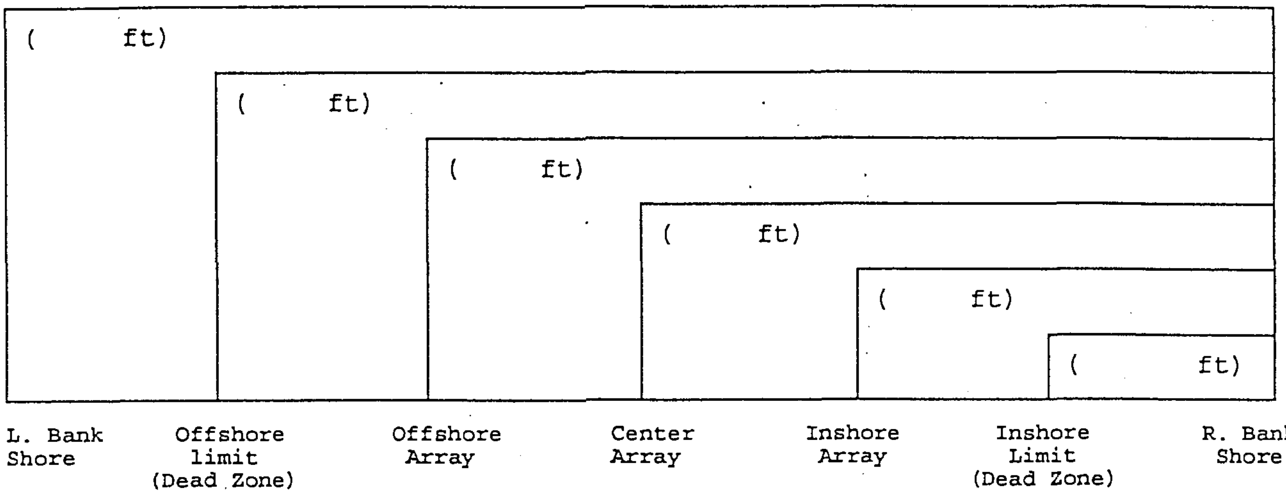
Appendix C.2. Field camp gas and oil consumption form.

ALASKA DEPARTMENT OF FISH AND GAME
CFM&D DIVISION

Array Distance and Bottom Profile Form (3 Array System)

Project Location - Kvichak Smolt ______ Date ______

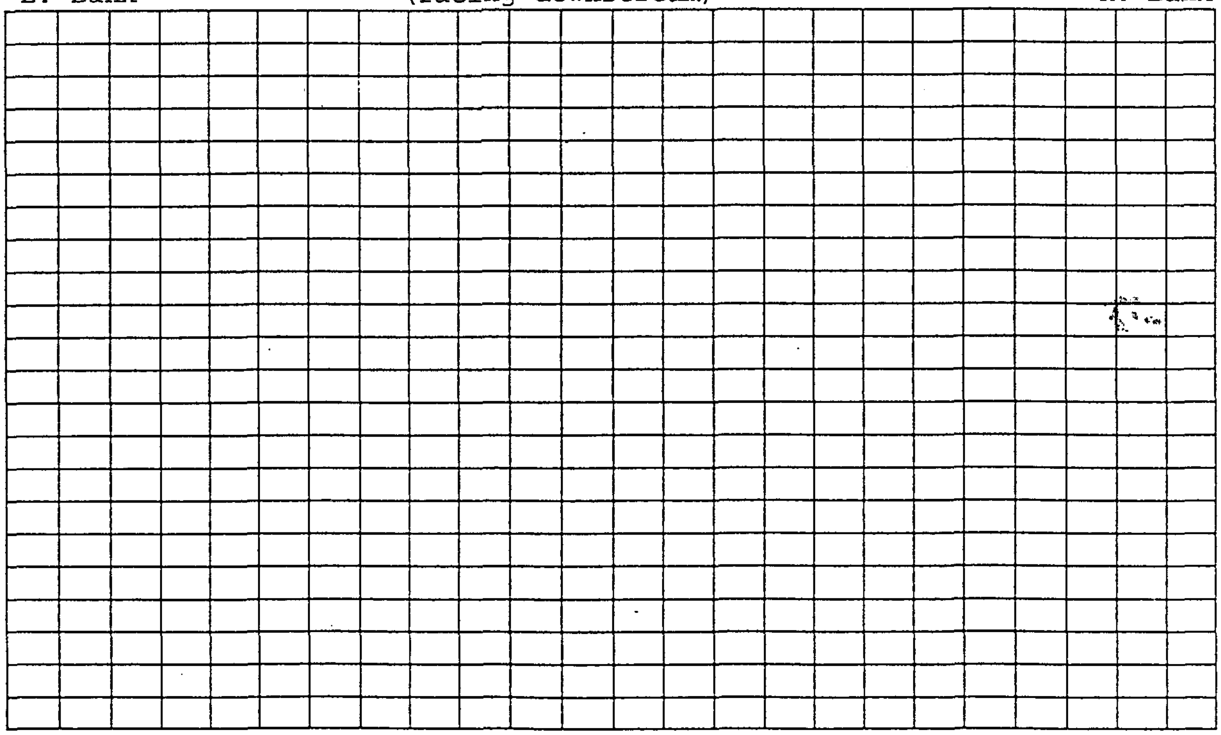
ARRAY DISTANCES
(facing downstream)



BOTTOM PROFILE
(facing downstream)

L. Bank R. Bank

Depth (ft)



Width (ft)

Form No. BB-95-01B

Appendix C.3. Array distance and bottom profile form (Kvichak River).

ALASKA DEPARTMENT OF FISH AND GAME
CFM&D DIVISION

Array Distance and Bottom Profile Form (3 Array System)

Project Location - Egegik River Smolt Date - ____________

ARRAY DISTANCES
(facing downstream)

(ft)

(ft)

(ft)

(ft)

(ft)

(ft)

L. Bank Shore	Inshore limit (Dead Zone)	Inshore Array	Center Array	Offshore Array	Offshore Limit (Dead Zone)	R. Bank Shore

BOTTOM PROFILE
(facing downstream)

L. Bank R. Bank

Depth (ft)

Width (ft)

Form No. BB-95-01A

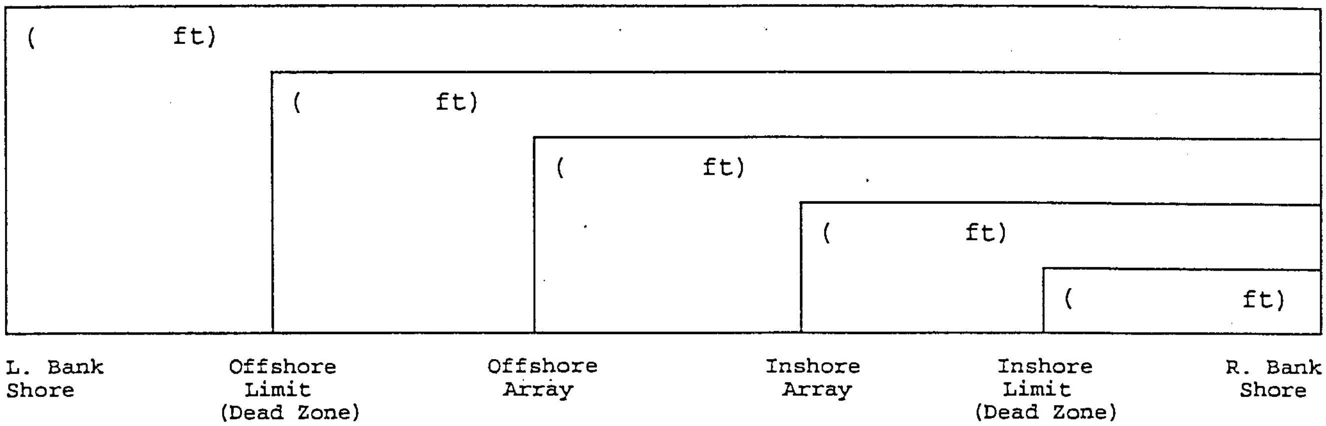
Appendix C.5. Array distance and bottom profile form (Egegik River).

ALASKA DEPARTMENT OF FISH AND GAME
CFM&D DIVISION

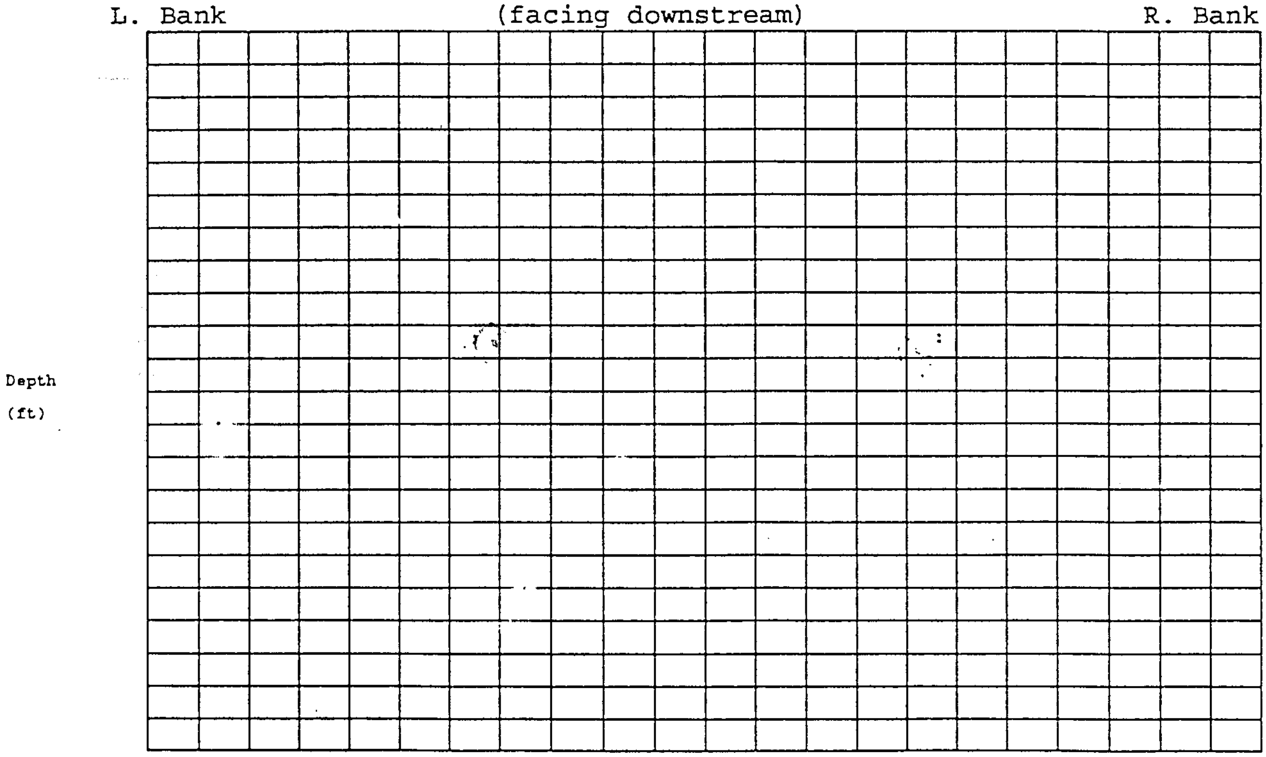
Array Distance and Bottom Profile Form (2 Array System)

Project Location - Ugashik River Smolt ____________ Date ____________

ARRAY DISTANCES
(facing downstream)



BOTTOM PROFILE
(facing downstream)



Form No. BB-95-01C

Appendix C.6. Array distance and bottom profile form (Ugashik River).

ALASKA DEPARTMENT OF FISH AND GAME
CFM&D DIVISION

Velocity Reading Form

Project Location ______ Kvichak River ______ Year ______

Equipment: Make ______ Teledyne Gurley ______ Model ______ 622 ______

Units - Clicks per 60 seconds (1 Click = 5 Revolutions)

Date	Depth	C L I C K S											
		Inshore Array				Center Array				Offshore Array			
		1st	2nd	3rd	AVG	1st	2nd	3rd	AVG	1st	2nd	3rd	AVG
	Surface												
	2 ft.												
	4 ft.												
	Sum (All AVG) / 3					*				*			
	ft/sec												
	Surface												
	2 ft.												
	4 ft.												
	Sum (ALL AVG) / 3					*				*			
	ft/sec												
	Surface												
	2 ft.												
	4 ft.												
	Sum (ALL AVG) / 3					*				*			
	ft/sec												
	Surface												
	2 ft.												
	4 ft.												
	Sum (ALL AVG) / 3					*				*			
	ft/sec												

* (Sum (ALL AVG) /3) X 5 = Revolutions;
Use Gurley Rating Tables to convert revolutions to ft/sec. or [(RPM-100)X.037]+3.71= ft/sec

Form No. BB-95-02A

Appendix C.7. Velocity reading form (Kvichak River).

ALASKA DEPARTMENT OF FISH AND GAME
CFM&D DIVISION

Velocity Reading Form

Project Location: Naknek River Smolt   Year: ____

Equipment: Make: Teledyne Gurley   Model: 625 (Pygmy) - (1 click = 1 revolution)
622 - (1 click = 5 revolutions)

Units - Clicks per 60 seconds

Date	Depth	CLICKS											
		Inshore Array				Center Array				Offshore Array			
		1st	2nd	3rd	AVG	1st	2nd	3rd	AVG	1st	2nd	3rd	AVG
	Surface												
	2 ft.												
	4 ft.												
	Sum (All AVG) / 3					*				*			
	ft/sec												
	Surface												
	2 ft.												
	4 ft.												
	Sum (ALL AVG) / 3					*				*			
	ft/sec												
	Surface												
	2 ft.												
	4 ft.												
	Sum (ALL AVG) / 3					*				*			
	ft/sec												
	Surface												
	2 ft.												
	4 ft.												
	Sum (ALL AVG) / 3					*				*			
	ft/sec												

Form No. BB-95-02B

* (Sum (ALL AVG) /3) X 1 = Revolutions for Model 625 (Pygmy); (Sum (ALL AVG) /3) X 5 = Revolutions for Model 622
Use Gurley Rating Tables to convert revolutions to ft/sec or RPM/60 = ft/sec for model 625 (Pygmy)
or [(RPM-100) x .037] + 3.71 = ft/sec for model 622

Appendix C.8. Velocity reading form (Naknek River).

ALASKA DEPARTMENT OF FISH AND GAME
CFM&D DIVISION

Velocity Reading Form

Project Location Egegik River Year ____________

Equipment: Make Teledyne Gurley Model 625 (Pygmy)

Units - Clicks per 60 seconds (1 Click = 1 Revolution)

Date	Depth	CLICKS											
		Inshore Array				Center Array				Offshore Array			
		1st	2nd	3rd	AVG	1st	2nd	3rd	AVG	1st	2nd	3rd	AVG
	Surface												
	2 ft.												
	4 ft.												
	Sum (All AVG) / 3					*				*			
	ft/sec												
	Surface												
	2 ft.												
	4 ft.												
	Sum (ALL AVG) / 3					*				*			
	ft/sec												
	Surface												
	2 ft.												
	4 ft.												
	Sum (ALL AVG) / 3					*				*			
	ft/sec												
	Surface												
	2 ft.												
	4 ft.												
	Sum (ALL AVG) / 3					*				*			
	ft/sec												

* (Sum (ALL AVG) /3) $\bar{X}$ 1 = Revolutions;
Use Gurley Rating Tables to convert revolutions to ft/sec or RPM/60 = ft/sec.

Form No. BB-95-02B

Appendix C.9. Velocity reading form (Egegik River).

ALASKA DEPARTMENT OF FISH AND GAME
CFM&D DIVISION

Velocity Reading Form

Project Location: Ugashik River Smolt   Year: ____________

Equipment: Make: Teledyne Gurley   Model: 622

Units - Clicks per 60 seconds (1 Click = 5 Revolutions)

Date	Depth	CLICKS							
		Inshore Array				Offshore Array			
		1st	2nd	3rd	AVG	1st	2nd	3rd	AVG
	Surface								
	2 ft.								
	4 ft.								
	Sum (All AVG) / 3					*			
	ft/sec								
	Surface								
	2 ft.								
	4 ft.								
	Sum (ALL AVG) / 3					*			
	ft/sec								
	Surface								
	2 ft.								
	4 ft.								
	Sum (ALL AVG) / 3					*			
	ft/sec								
	Surface								
	2 ft.								
	4 ft.								
	Sum (ALL AVG) / 3					*			
	ft/sec								

Form No. BB-95-02C

* (Sum (ALL AVG) /3) X 5 = Revolutions;
Use Gurley Rating Tables to convert revolutions to ft/sec. or [(RPM-100)X.037]+3.71= ft/sec

Appendix C.10. Velocity reading form (Ugashik River).

ALASKA DEPARTMENT OF FISH AND GAME
CFM&D DIVISION

Page______

SONAR ADJUSTMENT LOG

Project__________________ Date___________

Time	Velocity Setting	Array	False Count Log		Resurface Log			
					Inshore Half		Offshore Half	
			No. to Subtract	Reason	Surface	Set	Surface	Set

Form No. BB-95-05

Appendix C.11. Sonar adjustment log.

SONAR ADJUSTMENT LOG (Form BB-95-05) INSTRUCTIONS

Refer to the SAMPLE FORM for guidance on how to complete the Sonar Adjustment Log. Parameter that are recorded on this form are:

Header: Project - e.g., Kvichak River Smolt

Date - mm/dd/yy

Page - begin with 1 and number consecutively throughout the field season

1. Time - military time, 0001 - 2400 hours

2. Velocity Setting - record the velocity setting on your counter

   Kvi, Nak, Ege & Uga - sec/ft, to the nearest 0.01 sec/ft

3. Array - I = Inshore Array
C = Center Array
O = Offshore Array

4. False Count Log:

   a. No. to Subtract - to the nearest whole number

   b. Reason - Indicate the reason for the false counts (e.g., resurface, boat, log, ice, snow, rain, wave action, high winds/specify direction and speed, etc.)

   This section can be expanded to one or more lines as needed to record specifics on counting conditions. See instuctions below for recording counting conditions.

5. Resurfacing Log:

   a. Inshore Half

   (1) Surface - record the surface setting on your counter to the nearest 0.01 m (Kvi, Nak, Ege & Uga).

SONAR ADJUSTMENT LOG (Form BB-95-05) INSTRUCTIONS (p. 2 of 3)

5. Resurfacing Log (continued):

    (2) Set - record the depth setting on your counter to the nearest 0.01 m (Kvi, Nak, Ege & Uga).

    b. Offshore Half

    (1) Surface - record the surface setting on your counter to the nearest 0.01 m (Kvi, Nak, Ege & Uga).

    (2) Set - record the depth setting on your counter to the nearest 0.01 m (Kvi, Nak, Ege & Uga).

In addition to this information the Sonar Adjustment Log will also be used to record counting conditions. Items which should be recorded are:

1. Wind and Wave Action: e.g., flat calm, slight ripple, waves but no white caps, white caps.

    Note the wind direction and approximate speed (e.g., SE 30 mph).

2. Percipitation: Note periods of rain or snow. Record times when percipition start and stop.

3. False Counts: Note false counts that can be attributed to increased wind or percipitation.

4. Bird Activity: Are there birds feeding on smolt in the area? If so, what kind are they (e.g., species) and how many are there? How does the relative abundance of these feeding birds vary over time.

5. Justification for Resurfacing Depth Setting :

    Any time you dial your resurfacing depth down below the following specified setting (Kvi, Nak, Ege & Ugashik = 0.02 to 0.05 m) for your project, be sure to justify why you selected an alternate setting.

6. Depth of Fish Schools:

    Note the depth of fish schools you observe on the oscilloscope. Express this observation as a range (e.g., .05 to 1.50 m below the surface).

SONAR ADJUSTMENT LOG (Form BB-95-05) INSTRUCTIONS (p. 3 of 3)

7. Equipment Problems and Procedures:

   Note any problems that occur with the counter or transducers (e.g., transducer #7 on the inshore array malfunctioning, unplugged at 0800 hrs, 5/23/91). If the item is repaired or replaced, record when the repairs are made and when the item went back on line. Also if it can not be fixed, it would be a good to include periodic reminders on your form (e.g., transducer #7 on inshore array unplugged since 0800 hrs, 5/23/91).

   Also record when oscilloscope tests are conducted on the transducers and the results (e.g., scope tested all ducers, all OK).

ALASKA DEPARTMENT OF FISH AND GAME
CFM&D DIVISION

Average Depth and Velocity Data Entry Form

Project Location________________ Year__________

Smolt Day	Average Depth (0.00 m)			Velocity Over Arrays (0.00 ft/sec)			
	Inshore	Center	Offshore	Index	Inshore	Center	Offshore

Form No. BB-95-03A

Appendix C.12. Average depth and velocity data entry form (3 arrays).

ALASKA DEPARTMENT OF FISH AND GAME
CFM&D DIVISION

Average Depth and Velocity Data Entry Form

Project Location__________________ **Year**__________

Smolt	Average Depth (0.00 m)		Velocity Over Arrays (0.00 ft/sec)		
Day	Inshore	Offshore	Index	Inshore	Offshore

Form No. BB-95-03B

Appendix C.13. Average depth and velocity data entry form (2 arrays).

ALASKA DEPARTMENT OF FISH AND GAME
CFM&D DIVISION

Average Depth Setting and Fish Passage Form

Project Location______________________ Smolt Day______________

Time hours	Average Depth Setting (0.00 m)			Depth of Fish Passage (0.00m from surface)		
	Inshore	Center	Offshore	Inshore	Center	Offshore
1200						
1300						
1400						
1500						
1600						
1700						
1800						
1900						
2000						
2100						
2200						
2300						
2400						
0100						
0200						
0300						
0400						
0500						
0600						
0700						
0800						
0900						
1000						
1100						
Total	______	______	______			
Average[a]	______	[a] ______	[a] ______			

[a] Transcribe Avg. Depths for each smolt day to Form BB-95-03A.

Form No. BB-95-04A

Appendix C.14. Average depth setting and fish passage form (3 arrays).

ALASKA DEPARTMENT OF FISH AND GAME
CFM&D DIVISION

Average Depth Setting and Fish Passage Form

Project Location ______________________________ **Smolt Day** ______________

Time hours	Average Depth Setting (0.00 m)		Depth of Fish Passage (0.00m from surface)	
	Inshore	Offshore	Inshore	Offshore
1200				
1300				
1400				
1500				
1600				
1700				
1800				
1900				
2000				
2100				
2200				
2300				
2400				
0100				
0200				
0300				
0400				
0500				
0600				
0700				
0800				
0900				
1000				
1100				
Total	________	________		
Average[a]	________	[a] ________		

[a] Transcribe Avg. Depths for each smolt day to Form BB-95-03B.

Form No. BB-95-04B

Appendix C.15. Average depth setting and fish passage form (2 arrays).

ALASKA DEPARTMENT OF FISH & GAME | Daily Sonar Log Form (3 Arrays) | CFM&D DIVISION

Project Location - ____________________

Front Side

Dates _______ Page ____

Initials	Hour	Adj. Page	Disable Time	Inshore Actual	Inshore False	Inshore Final Adj.	Center Actual	Center False	Center Final Adj.	Offshore Actual	Offshore False	Offshore Final Adj.
	1200											
	1300											
	1400											
	1500											
	1600											
	1700											
	1800											
	1900											
	2000											
	2100											
	2200											
	2300											
	2400											
	0100											
	0200											
	0300											
	0400											
	0500											
	0600											
	0700											
	0800											
	0900											
	1000											
	1100											

Outmigration:	Total adjusted counts	X	Velocity correction	X	Fish/Count	=			
Inshore:	________	X	________	X	________	=	________	$= EC_I/11$	________
Center:	________	X	________	X	________	=	________	$= EC_{II}/11$	________
Offshore:	________	X	________	X	________	=	________	$= EC_{III}/11$	________
					Expanded Sonar Counts	=	________		

Final adjusted count = (actual - false counts) / (1 - (disable time/3600))

See back side for calculating outmigration estimate.

Form No. BB-95-06B

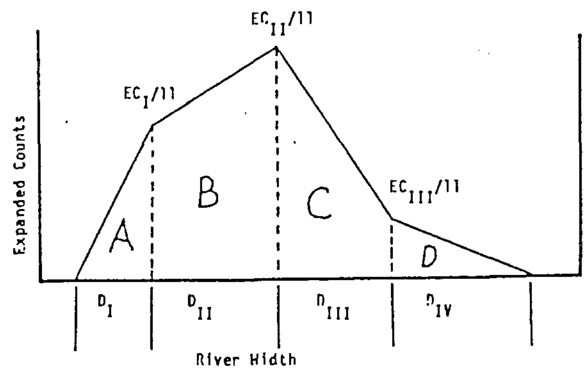
Back Side

$$A:\ (\tfrac{1}{2})(\underset{D_I}{\quad})(\underset{EC_I/11}{\quad}) = \_\_\_\_\_\_\_\_$$

$$B:\ (\underset{EC_I/11}{\quad} + \underset{EC_{II}/11}{\quad})(\underset{D_{II}}{\quad})(\tfrac{1}{2}) = \_\_\_\_\_\_\_\_$$

$$C:\ (\underset{EC_{II}/11}{\quad} + \underset{EC_{III}/11}{\quad})(\underset{D_{III}}{\quad})(\tfrac{1}{2}) = \_\_\_\_\_\_\_\_$$

$$D:\ (\tfrac{1}{2})(\underset{D_{IV}}{\quad})(\underset{EC_{III}/11}{\quad}) = \_\_\_\_\_\_\_\_$$



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Daily Outmigration Estimate

Appendix C.16. Daily sonar log (3 arrays).

ALASKA DEPARTMENT OF FISH & GAME

Daily Sonar Log Form
(2 Arrays)

CFM&D DIVISION

Project Location - Ugashik River Smolt

Front Side

Dates ______ Page ___

Initials	Hour	Adj. Page	Disable Time	Inshore Actual	Inshore False	Inshore Final Adj.	Offshore Actual	Offshore False	Offshore Final Adj.	Comments
	1200									
	1300									
	1400									
	1500									
	1600									
	1700									
	1800									
	1900									
	2000									
	2100									
	2200									
	2300									
	2400									
	0100									
	0200									
	0300									
	0400									
	0500									
	0600									
	0700									
	0800									
	0900									
	1000									
	1100									

Outmigration:	Total adjusted counts	X	Velocity correction	X	Fish/Count				
Inshore:	________	X	________	X	________	=	________	= EC_I /11	________
Offshore:	________	X	________	X	________	=	________	= EC_{II} /11	________

Expanded Sonar Counts = ________

Final adjusted count = (actual - false counts) / (1 - (disable time/3600))

See back side for calculating outmigration estimate.

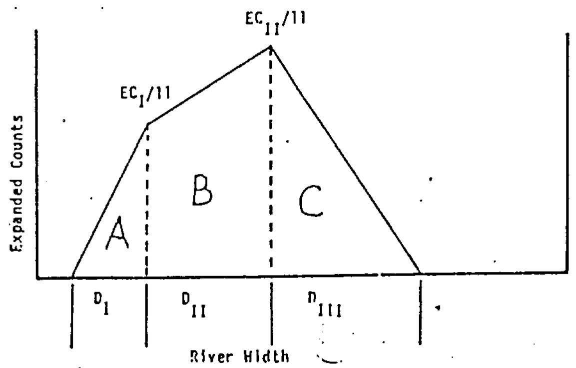
Form No. BB-95-06A

Back Side

$$A: (\tfrac{1}{2})(\underset{D_I}{\quad})(\underset{EC_I/11}{\quad}) = \_\_\_\_\_\_\_\_$$

$$B: (\underset{EC_I/11}{\quad} + \underset{EC_{II}/11}{\quad})(\underset{D_{II}}{\quad})(\tfrac{1}{2}) = \_\_\_\_\_\_\_\_$$

$$C: (\underset{EC_{II}/11}{\quad} + \emptyset)(\underset{D_{III}}{\quad})(\tfrac{1}{2}) = \_\_\_\_\_\_\_\_$$



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Daily Outmigration Estimate

Appendix C.17. Daily sonar log (2 arrays).

ALASKA DEPARTMENT OF FISH AND GAME
CFM&D DIVISION

Smolt Fyke Net Sample Log

Project Location________________________________

Cod End Sample Number	Type AWL LF	Number of Smolt	Time		Date	Smolt Day	Initials	Comments
			Set	Pull				

Form No. BB-95-07

Appendix C.18. Smolt fyke net sampling log.

SMOLT FYKE NET SAMPLING LOG (Form BB-95-07) INSTRUCTIONS

In addition to summarizing fyke net sampling activities, information on this form can be used to calculate catch-per-unit-effort data which can be used to verify smolt presence, smolt absence, smolt passage, and species composition. This information is particularly important at times when sonar counts are in question due to marginal conditions.

Header: Project (e.g., Egegik River Smolt) Year (e.g., 1995)

1. Cod End Sample Number - For all fyke net sets which catch sockeye salmon smolt samples, number the cod end samples consecutively from the beginning of the project to the end (e.g., 01-99). For fyke net sets which do not produce samples, record a dash (-) in the Cod End Sample Number column along with the date, fishing times, and any pertinent comments (e.g., total catch = 2 boreal smelt, 1 chinook smolt).

2. Type AWL or LF - age-weight-length (AWL) or length frequency (LF). If AWL and LF samples were taken from the same Cod End Sample, enter each on a separate line.

3. Number of Smolt - This is the number of AWL or LF samples taken from the Cod End Sample.

4. Time: Set - Military time (e.g., 0001-2400 hours) set begun, to the nearest minute
   Pull - Military time (e.g., 0001-2400 hours) set ended, to the nearest minute

5. Date - mm/dd (e.g., 05/22)

6. Smolt Day - mm/dd-dd (e.g., 05/22-23)

7. Initials - Fyke net samplers initials.

8. Comments - Enter the total catch for the set in this column. This number will often be an estimate. "Total catch ~800 + 2 smelt, 1 coho, 3 chinook" is fine. If species is not specified, we will assume they are all sockeye. Please do note what type and how many of other species that are caught. The size of other species should be entered on the AWL or LF forms when time permits. Bottom dwellers such as sticklebacks, sculpins, and lampreys can be excluded because they are not counted by the sonar.

SMOLT FYKE NET SAMPLING LOG (Form BB-95-07) INSTRUCTIONS (p 2 of 2)

Set/Pull Times, Date, and Smolt Day

Record all set and pull times in military time (e.g., 24 hour clock) to the nearest whole minute. Each calendar date (mm/dd) begins at 0001 hours (e.g., 1 minute after midnight) and ends at 2400 hours. Each smolt day (mm/dd-dd) begins at 1200 hours and ends at 1159 hours the next calendar day. The calendar date and smolt day for all fyke net sets are determined by the set time. Therefore if you set a fyke net at 2330 hours 5/22 and pull it at 0400 hours on 5/23, the date for this set will be 5/22 and the smolt day will be 5/22-23. Examples of set times, pull times, dates, and smolt days for various fyke netting scenarios are presented below:

Fyke Netting Scenarios	Set Time (Set Date)	Pull Time (Pull Date)	Date	Smolt Day
Late PM Set - set before midnight, pulled at midnight	2245 (5/22)	2400 (5/22)	5/22	5/22-23
Midnight Set - set at midnight, pull in early AM	2400 (5/22)	0015 (5/23)	5/22	5/22-23
Late PM/Early AM Set - set before midnight, pull in early AM	2335 (5/22)	0115 (5/23)	5/22	5/22-23
Early AM Set - set right after midnight, pull in early AM	0001 (5/23)	0105 (5/23)	5/23	5/22-23
Late AM Set - set in late AM, pulled before noon	1100 (5/23)	1159 (5/23)	5/23	5/22-23
Late AM/Early PM Set - set before noon, pull in early PM	1159 (5/23)	1245 (5/23)	5/23	5/22-23
Noon Set - set at noon, pull in early PM	1200 (5/23)	1450 (5/23)	5/23	5/23-24

ALASKA DEPARTMENT OF FISH AND GAME
CFM&D DIVISION

Smolt Age-Weight-Length Form

Date________

Project Location______________________________ Smolt Day__________

Sampler's Initials______________________________ Cod End #__________

Scale Ager's Initials__________________ Military Time: Cod End Set________

Remarks: ______________________________ Cod End Pull________

______________________________ Duration (min)________

#	Fork Length (mm)	Weight (Nearest 0.1g)	Age	Comments	#	Fork Length (mm)	Weight (Nearest 0.1g)	Age	Comments
1					26				
2					27				
3					28				
4					29				
5					30				
6					31				
7					32				
8					33				
9					34				
10					35				
11					36				
12					37				
13					38				
14					39				
15					40				
16					41				
17					42				
18					43				
19					44				
20					45				
21					46				
22					47				
23					48				
24					49				
25					50				

Form No. BB-95-08

Appendix C.19. Smolt age-weight-length form.

ALASKA DEPARTMENT OF FISH AND GAME
CFM&D DIVISION

Smolt Length Frequency Form

Date ______

Project Location ______________________ Smolt Day ______

Sampler's Initials ______________________ Cod End # ______

Page Summary: Age 1 - ___ (n), ___ (%) Time: Cod End Set ______

Age 2 - ___ (n), ___ (%) Cod End Pull ______

Total - ___ (N) Duration (min) ______

n	Length	Tally	n	Length	Tally	n	Length	Tally
	55 mm			85 mm			115 mm	
	56 mm			86 mm			116 mm	
	57 mm			87 mm			117 mm	
	58 mm			88 mm			118 mm	
	59 mm			89 mm			119 mm	
	60 mm			90 mm			120 mm	
	61 mm			91 mm			121 mm	
	62 mm			92 mm			122 mm	
	63 mm			93 mm			123 mm	
	64 mm			94 mm			124 mm	
	65 mm			95 mm			125 mm	
	66 mm			96 mm			126 mm	
	67 mm			97 mm			127 mm	
	68 mm			98 mm			128 mm	
	69 mm			99 mm			129 mm	
	70 mm			100 mm			130 mm	
	71 mm			101 mm			131 mm	
	72 mm			102 mm			132 mm	
	73 mm			103 mm			133 mm	
	74 mm			104 mm			134 mm	
	75 mm			105 mm			135 mm	
	76 mm			106 mm			136 mm	
	77 mm			107 mm			137 mm	
	78 mm			108 mm			138 mm	
	79 mm			109 mm			139 mm	
	80 mm			110 mm			140 mm	
	81 mm			111 mm			141 mm	
	82 mm			112 mm			142 mm	
	83 mm			113 mm			143 mm	
	84 mm			114 mm			144 mm	

Form No. BB-95-09

Appendix C.20. Smolt length frequency form.

ALASKA DEPARTMENT OF FISH AND GAME
CFM&D DIVISION

Climatological and Stream Observation Form

Project Location ______________________________ Year ________________

Date (mm/dd)	Sky		Precipitation[a]			Wind Dir.-Vel.		Air Temp. C		Water Temp. C		Water Color	
	am	pm	am	pm	amt	am	pm	8am	8pm	8am	8pm	am	pm

Form No. BB-95-10

Sky Codes

0 No observation
1 Clear sky, < 1/10 cloud cover
2 Cloud cover < 1/2 sky
3 Cloud cover > 1/2 sky
4 Completely overcast
5 Fog or thick haze

Precipitation Codes

0 No observation
A Intermittent rain
B Continuous rain
C Snow
D Snow and rain
E Hail
F Thunderstorm

Water Color Codes

0 No observation
1 Clear
2 Light brown
3 Brown
4 Dark brown
5 Murky or glacial

[a] Amt = Amount of precipitation (nearest 0.01 inches) accumulated in 24 hours.

Appendix C.21. Climatological and stream observation form.

ALASKA DEPARTMENT OF FISH AND GAME CFM&D DIVISION

Project__________________ Smolt Project Radio Log Page _____ of _____

Year______________________

Date	Time	Sonar Counts		Percent Age Composition		Water Temp *C	Comments
		Daily	Cumulative	Age 1.	Age 2.	(0800 hrs)	

Form No. (BB-95-13)

Appendix C.22. Sockeye salmon smolt project radio log.

APPENDIX D.

Tent Furnishings

1 stove, oil - Perfection, Model H940G, 38,000 BTU output

1 radio, single side band - Icom, Model M700 with 3230/4560 frequency antenna

2 chairs

2 lanterns - Coleman, duel fuel wi/ mantles

1 stove - Coleman, 2-burner, duel fuel

appropriate forms and clipboards

calculator (non-solar), pencils, paper, stapler

APPENDIX E.

AWL Sampling Gear

1 scale, twin balance - with 0.1 g capability

1 measuring board (mm), smolt

3 slides, microscope (boxes) - frosted

3 slides, microscope (boxes) - plain

1 scotch tape (roll) - with dispenser

2 buckets, plastic (5 gal)

APPENDIX E. (Continued)

AWL Sampling Gear

2 trays

1 MS-222 anesthetic (5 g) - Argent Finquel, white powder in a brown bottle

1 scalpel - with spare blades

1 needles, dissecting - for teasing scale smears on microscope slides

1 towels, paper - for cleaning hands and equipment between samples

APPENDIX F.

Weather Recording Equipment

2 thermometers, hand-held - for water temperatures (° C)

1 thermometer, maximum/minimum - for air temperature (° C)

1 rain gauge - to the nearest 0.5 mm or 0.01 in

1 wind vane - wind direction indicator

1 compass - to varify wind direction

1 wind meter - wind speed (mph)